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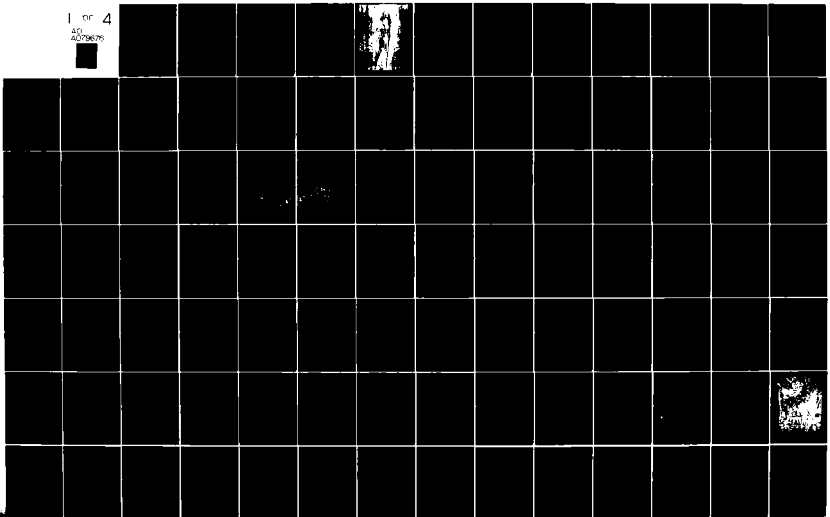

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FINAL

LEVEL

ENVIRONMENTAL STATEMENT

LAKE CITY STATION - UNIT 1

DDC

BASIC DATA SUBMITTED BY

PENNSYLVANIA ELECTRIC COMPANY

AND

GPU SERVICE CORPORATION

IN CONSULTATION WITH

GILBERT ASSOCIATES INCORPORATED

IN SUPPORT OF ITS APPLICATION
DATED MAY 22, 1972 FOR
PERMIT TO CONSTRUCT INTAKE
AND DISCHARGE FACILITIES

PREPARED BY

U. S. ARMY ENGINEER DISTRICT, BUFFALO, NEW YORK

17 SEPTEMBER 1973

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A detailed analysis of the environmental impacts related to the construction and operation of an oil-fueled electric generating station. The proposed plant will occupy a 639 acre site on the south shore of Lake Erie in Girard Township, Erie County, Pennsylvania. Electrical power generated by this facility will vary between 245 megawatts and 295 megawatts. The water intake and effluent discharge system will be located in Lake Erie. Approximately 1.4 million barrels of No. 2 fuel oil will be consumed annually.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Pennsylvania Electric Company
LAKE CITY COMBINED CYCLE
POWER PLANT

Lake City, Erie County, Pennsylvania

17 September 1973

( ) Draft (X) Final Environmental Statement

Responsible Office: U. S. Army Engineer District, Buffalo, New York

1. Name of Action: (X) Administrative ( ) Legislative

2. Description of Action: Construction of an oil-fueled electric generating unit with intake and discharge structures, together with other appurtenances.

3. a. Environmental Impacts: Occupation of approximately 66 acres of land, discharge of quantities of heat, air-borne emissions, liquid effluents and sound energy, and the receipt and consumption of approximately 1.4 million barrels of fuel oil per year.

b. Adverse Environmental Effects: All impacts listed above are to some degree environmentally adverse except the receipt of fuel oil. The receipt and handling of the fuel oil are potentially adverse.

4. Alternatives: Another location, no project, non-fossil fuel, and other types of cooling systems.

5. Comments Received:

Metropolitan Planning Department, Erie County
Federal Aviation Administration
Department of Commerce
Erie County Department of Health
Environmental Protection Agency, Philadelphia, Pennsylvania
Department of Environmental Resources, Commonwealth of Pennsylvania
United States Department of the Interior
Pennsylvania Fish Commission
Federal Power Commission

6. Draft Statement to CEQ February 7, 1973
Final Statement to CEQ ______________.

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1. PROJECT DESCRIPTION

1.1 INTRODUCTION

This is the Final Environmental Impact Statement for the construction and operation of an electric generating station to be located near Lake City, Pennsylvania.

1.2 THE APPLICANT

Pennsylvania Electric Company (PENELEC), is an electric public utility incorporated in Pennsylvania. Its headquarters are at 1001 Broad Street, Johnstown, Pennsylvania, 15907.

PENELEC is a subsidiary of General Public Utilities Corporation (GPU). The other utility subsidiaries of GPU are Metropolitan Edison Company, a Pennsylvania corporation; and Jersey Central Power and Light Company and New Jersey Power and Light Company, which are New Jersey corporations. These four companies comprise the GPU System, the bulk power facilities of which are planned and operated on a fully integrated basis. Since electric generating capacity is planned to meet system requirements, the need for the installation at Lake City must be examined in relation to GPU System requirements and costs, as well as to those of PENELEC.

PENELEC and the other GPU subsidiaries are members of the Pennsylvania-New Jersey-Maryland Interconnection (PJM) in which there is both coordinated planning and coordinated operation of major generating and transmission facilities. PENELEC is also interconnected with several utilities outside of PJM.

Figure 1-1 is a map of the service areas and transmission lines of the GPU System and of the principal transmission lines of its neighbors. The area served by PENELEC is shown in yellow.

Figure 1-2 is a map locating the proposed plant on the Lake Erie shore west of Erie in the PENELEC Northwestern Division.

1.3 THE APPLICANT'S PRODUCT

The principal business of PENELEC is the production, purchase, transmission distribution, and sale of electricity. At the

end of 1971, PENELEC had approximately 458,000 electric customers. It also furnishes steam heat service in Erie, Pennsylvnia.

1.3.1 Why the Product Must be Made Available

The use of electric energy in the area served by PENELEC has steadily increased (as indicated in Tables 1-1,1-2, and 1-3) and a comparable rate of increase is expected during the next few years. The Lake City station capacity is needed to meet these expected demands.

1.3.1.1 Demand/Supply Forecast

In the following tabulations there are shown the forecast demands and planned capacity additions from 1972 to 1980 for the following areas:

Table 1-1	Northwestern Division of PENELEC - the area around Erie, Pennsylvania (as shown in Figure 1-1), which is the area primarily served by the proposed facilities.
Table 1-2	The whole of the PENELEC (applicant's) System.
Table 1-3	The whole of the GPU System.

These tabulations make it evident that there is a present deficiency of generation in the Erie area, which will grow by 1974 to an amount comparable with the capacity of the proposed nominal 250MW installation.

There is also an expected continued growth in PENELEC and GPU which requires the installation of substantial amounts of capacity in addition to the nominal 250MW proposed unit.

In each of the above tabulations, the forecast maximum loads have been increased by a 20 percent allowance for reserve capacity. This reserve is a GPU System requirement and is strictly applicable only to the maximum summer loads of GPU, this being the basis of generating capacity planning required by the participation of GPU in PJM. Because of diversity among areas and among the companies in GPU, the separate reserve requirements are at times more or less than this 20 percent rate. The use of a 20 percent reserve has also been endorsed by the Pennsylvania Public Utility Commission (PUC) and the Federal Power Commission.

1.4 OVERALL PROJECT DESCRIPTION

1.4.1 The Site

The Lake City Combined Cycle Power Plant will be located in Girard Township about twelve miles southwest of Erie, Pennsylvania, along the southern shore of Lake Erie one mile west

TABLE 1-1

PENELEC
NORTHWESTERN REGION
LOADS & SCHEDULED CAPACITY

	LOADS (MW)		
	Winter Peak	Winter Peak + 20%	Installed Capacity (MW)
1966	284	341	118
1967	294	353	118
1968	315	378	118
1969	316	379	118
1970	375	450	118
1971	349	419	118
1972	383	460	187
1973	408	490	187
1974	436	523	439
1975	466	559	439
1976	498	598	439
1977	533	640	439
1978	569	683	439
1979	609	731	439
1980	650	780	439

TABLE 1-2

PENELEC PROJECTED LOADS
AND SCHEDULED CAPACITY

	LOADS (MW)		
	Winter Peak	Winter Peak + 20%	Installed Capacity (MW)
1966	1152	1384	1288
1967	1237	1484	1232
1968	1328	1594	1232
1969	1493	1792	1766
1970	1645	1974	1814
1971	1638	1966	1880
1972	1805	2166	2068
1973	1925	2310	2272
1974	2060	2472	2452
1975	2205	2646	2678
1976	2360	2832	2998
1977	2525	3030	3138
1978	2700	3240	3138
1979	2890	3468	3138
1980	3090	3708	3458

TABLE 1-3

GPU SYSTEM PROJECTED LOADS AND SCHEDULED CAPACITY

	LOADS (MW)		
	Summer Peak	Summer Peak + 20%	Installed Capacity (MW)
1966	2921	3505	3111
1967	3061	3673	2791
1968	3540	4248	2973
1969	3868	4642	3407
1970	4071	4885	4585
1971	4363	5236	5171
1972	4934	5921	5438
1973	5379	6455	6228
1974	5863	7036	7093
1975	6377	7652	8168
1976	6954	8345	8503
1977	7583	9100	9056
1978	8269	9923	10126
1979	9022	10826	10642
1980	9851	11821	11737

of the town of Lake City. The plant site consists of 639 acres and is bounded by the lake shore on the north, Elk Creek on the east, and Lake Road (Route 5) on the south. The actual location of this plant will be near Elk Creek on the northern part of the site.

That portion of the site, adjacent to Lake Erie and Elk Creek, is wooded with the remaining portions being open farm land. The terrain is gently rolling except along the lake shore and Elk Creek which have steep slopes and bluffs (see Figure 1-3).

1.4.2 The Generation Method

The Lake City Plant will be a combined cycle plant and the electricity produced from this plant will be generated by three hydrogen cooled electrical generators.

This type of generator will not be a new innovation, but the method used to drive these generators will differentiate this design from the conventional power plant.

The prime mover of the Lake City Plant will consist of 2 Westinghouse W-501B industrial combustion turbines, 2 pre-engineered waste heat boilers, 1 steam turbine, 1 condenser, and 3 electrical generators, plus the normal array of supporting systems. Two of the above generators will be coupled to the cold end of the two combustion turbines and each combustion turbine will turn its respective generator at 3600 rpm. The output of each unit will be controlled by metering the required amount of fuel to the combustion chambers of the combustion turbines.

Under normal operating conditions, the exit gas temperature from the combustion turbine will be approximately 950F as it flows through the exhaust ducting. This gas will be fired for the second time as it flows through the auxiliary duct burners and will raise the gas temperature to the level of 1200F. This hot gas will be exhausted through the heat recovery steam generator package and out through the stacks. However, in this process, a large percentage of the heat energy in the exhaust will be removed from the gas and this energy will be used for generating steam to drive the steam turbine. A third electrical generator will be coupled to the steam turbine and will also operate at 3600 rpm.

The output from these three generators will constitute the gross output from this plant. The output from this plant will vary from 245MW to 295MW due to variations in ambient air temperature and pressure. This particular behavior is an inherent characteristic of the combustion turbine. The plant wastes, discussed quantitatively in Section 3 and Appendix C, are referenced to the gross output and will not be subject to significant variation. However, as the generator load is reduced, the waste quantities will be correspondingly reduced.

1.4.3 The Cooling Scheme

The main cooling duty in the plant will be the condensation of the exhaust steam from the steam turbine. There will also be a requirement for cooling the oil in circulation in the steam turbine-generator and the hydrogen gas in the generator together with some other miscellaneous small requirements. This cooling will be effected in a closed recirculating cooling loop consisting of an evaporative mechanical draft cooling tower and a system of pumps which will pump from the water basin at the cooling tower to the plant, through the equipment constituting the heat load and back to the cooling tower. There the water will be cooled by the flowing current of air induced by the fan on the cooling tower. In cooling there will be an evaporation of some water to the air and an elevation of the air temperature. This evaporation will be in the order of 1400 gpm and must be replaced with make up from the lake.

The evaporation will have the further effect of concentrating the salts which are present in the make up from the lake and consequently there will have to be a continuous blowdown of the water from the closed cooling loop to maintain the concentration within acceptable limits. The amount of this blowdown will vary with the salt content in the lake at the time but it is not expected to exceed 1400 gpm.

The heated plant blowdown will be conveyed to the point of discharge 14 ft - 1 in. below the lake low water level by means of a submerged outfall located 100 ft beyond the submerged intake and plug and consists of a long pipe and a multiport diffuser. The diffuser will be essentially a manifold with a twofold purpose:

a. To distribute the plants blowdown effluent over a wide area.

b. To dilute the effluent into the cooler receiving lake water by turbulent mixing.

A further heat dissipation requirement will arise from the need for maintaining a cooling air supply to the combustion turbine blading. Some air heated in the course of compression will be taken from the main engine compressor discharge and passed over a finned tube heat exchanger before being ducted into the combustion turbine. The hot discharge air from the exchanger will pass to the atmosphere.

1.4.4 The Transmission Link with Existing Lines

The transmission link will be a single circuit 115 kv overhead line leaving the main power transformer bus structure and terminating at a new substation. This new substation will be

constructed to connect the new unit into the existing 115 kv transmission line crossing the southeast corner of the site. No new transmission lines leaving the site will be required for the proposed station.

1.4.5 Delivery and Storage of Fuel

The fuel used in both the combustion turbines and the auxiliary burners of this combined cycle plant will be ASTM No. 2 fuel oil. This fuel is presently planned to be delivered to the site either by tank trucks or by railroad tank cars. Once this fuel arrives at the site, it will be unloaded and stored in a tank farm which consists of two tanks. These tanks will be 48 ft in height by 150 ft in diameter with a capacity of 6,080,000 gallons each.

These tanks will be equipped with cone roofs and internal floating covers. The cone roof will be necessary for weather protection. The floating internal cover will be used for eliminating vapor emissions.

1.4.6 The Anticipated Life of the Project

All the conventional supporting components in this station will be designed for a normal 30 year life span. The two Westinghouse W501B combustion turbines will be guaranteed for 24,000 hours of normal operation at base load or equivalent between major overhaul.

1.5 PROJECT SCHEDULES

1.5.1 Permit Requirements

Prior to construction and operation, applications, reports, and plans have been submitted to the following regulatory agencies for approval:

<u>Federal Government</u>

U. S. Army Corps of Engineers: <u>Permit to Work in Navigable Waters</u>

Federal Environmental Protection Agency: <u>Permit to Discharge in Navigable Waters</u>

<u>Commonwealth of Pennsylvania</u>

Department of Environmental Resources

Bureau of Air Quality and Noise Control
Division of Abatement and Compliance:
<u>Application for Plan Approval Prior to Construction or Modification of Combustion Units other than Incinerators</u>
(Permit #25-306-006 Received)

Bureau of Water Quality Management
Division of Industrial Wastes and
Division of Water Supply and Sewage:
Application for Water Quality Management Permit
Pollution Incident Prevention Plan
(Permit #2572205 Received)

Division of Dams and Encroachments:
Application for Permit to Construct
(Permit #20200 Received)

Department of Labor and Industry
Bureau of Occupational and Industrial Safety
Approval of Plans and Specifications Prior to Construction
Boiler Division Approval Received 11/11/72
Building Division Approval Received 11/19/72
Bureau of Fire Prevention
Pennsylvania State Police
Fuel Storage Permit
(Permit #173,290 Received)

Pennsylvania Fish Commission
Blasting Permit

Department of Highways
Access Road Permit
(Permit #P-164492 Received)

Public Utility Commission
Certificate of Convenience
(Application Docket #97219 Decision rendered 8/21/72)

Erie County Department of Health
Division of Environmental Health
Application for Sewage Disposal System
(Received - #163971)

1.5.2 Construction Schedule

The preliminary construction schedule estimates that Lake City Station will require 31 months to build. The estimated cost for this proposed project herein described, including interest during construction and excluding substation costs, is $51,303,000.00

1.6 SPECIFIC DESCRIPTIONS

1.6.1 Construction and Installation Phase

1.6.1.1 Site Preparation

Major site preparation for the proposed facility was scheduled to begin in the fall of 1972. Site survey and core boring investigations began in March 1972.

These site preparations include general categories as follows:
a. Clearing and grubbing
b. Earthmoving

c. Installation of drainage facilities

It is anticipated that tree and similar plant matter disposal will be either by burning or by chipping methods. There will be a disposal problem for those trees too large to chip. Burning will be utilized if permitted by the regional representative of the Commonwealth of Pennsylvania, Department of Environmental Resources. Otherwise this plant matter will be disposed of in an off-site sanitary landfill.

Earthmoving will be performed in order to provide an acceptable area upon which to build the various plant components.

During the site preparation phase a permanent storm-water drainage system will be installed. This system will consist of concrete catch basins interconnected with corrugated metal pipe. The portions of the storm drainage system which will intercept sediment, oil, and chemical contaminated drainage will be connected to sediment-oil interceptors or chemical treatment basins.

This system will be operational early in the construction phase. Therefore this system will be used to assist in the control of sediment in the storm drainage that occurs as a result of construction operations.

The system will be sized to convey the storm waters from a major storm, and will employ the Rational Method for computing the maximum storm runoff quantities.

The ultimate point of discharge for this system will be Lake Erie. Prior to storm water discharge into Lake Erie, however, sediment, oil, and chemical contamination will have been corrected, as described in Appendix C.

1.6.1.2 Temporary Construction Facilities

Temporary electrical power for construction will be supplied by a primary 34.5 kv transformer. Temporary secondary transformers and fused panelboards will distribute construction power as needed. Portable sewage facilities will be provided by the owner during the construction period. Various other man-made wastes will be disposed of by the subcontractors to off-site locations.

1.6.1.3 Permanent Offshore and Shoreline Facilities

1.6.1.3.1 Intake Structure

The location of the intake structure was determined by the lake bottom elevation and the navigational limitations imposed by the Corps of Engineers. Figure 1-4 shows the location of

the intake structure. The intake structure will be located 1200 feet N 20° W from the shoreline with its highest point 12 feet below lake low water level at elevation 556 ft-7in., 48 inches above the lake bottom silt line. At depths greater than 12 feet, the littoral drift becomes slight to negligible.

Figure 1-5 illustrates the intake structure design. Water from the lake will pass through a velocity cap equipped with fish screens which will result in a screen velocity of 0.5 fps and a maximum water approach velocity before the screen of 0.37 fps.

The intake will be formed by using a 60 in. ID pipe tee covered by a velocity cap to cause horizontal flow which fish can sense and take action to escape. On the end opposite to the water outlet, a removable plug will be installed for the dual purpose of facilitating maintenance operations and possible future installation of more intake tees for an ultimate two unit operation.

The water outlet end of the intake tee will convey the makeup flow into pipe of 24 in. ID.

The intake pipe will be installed parallel to the discharge pipe in a common trench. The trench which will be six feet in width, will be opened with explosives. One inch size gravel bedding material will be placed in the bottom, before installation of preassembled pipe sections. Then the trench will be backfilled with 2 in. size rock, 12 in. above pipe crown. The remainder of the trench will be filled with a 6 in. size rock to protect the pipe against wave forces and erosion effects in the shallow waters.

The center line of the intake pipe at the intake structure will be at elevation 550 ft-2 in. and will rise to the elevation 557 ft-9 in. at the discharge point into the pump house.

Before reaching the pump house, the pipe will bifurcate to ensure an even flow approach to the travelling screens and the pumps.

Dredging will be required from shore to the intake structure but the amount of dredged material will be limited due to the small size of the pipe lines required.

Blasting will probably be required at the shoreline and along the route of the intake pipe in the lake bed. Any blasting in Lake Erie waters will be licensed by the Pennsylvania Fish Commission and a permit issued by the U. S. Army Corps of Engineers.

1.6.1.3.2 Discharge Structure

The treated waste water effluent combined with the cooling tower blowdown of the combined cycle plant will be returned to Lake Erie by means of a submerged multiport diffuser pipe.

The diffuser pipe will be installed in shallow coastal waters and will discharge beyond 200 yds from the shoreline. (See Figure 1-4). It will be designed to maintain the final temperature of the diluted waste water effluent within 2 F of the surrounding waters.

The temperature difference between the lake and the discharging water will vary from 10 F in the summer to 20 F in the winter. Figure 1-5 illustrates the design of the discharge system. The discharge system will consist of a long outfall pipeline ended by a diffuser pipe running perpendicular to the principal direction of the lake currents. The diffuser pipe will have a diameter of 24 in. and a proposed length of 80 ft; the outfall pipeline will have a maximum length of 1400 ft.

The detailed design of this diffuser was arrived at based on hydrothermal analyses at 10 ft intervals along the diffuser. 2-1/2 in. risers with nozzles of the same diameter extend 24 in above the silt line at the lake bottom. The nozzles will alternate in opposite directions perpendicular to the diffuser pipe axis. The plant effluent flow consisting basically of cooling tower blowdown will be 1400 gpm and will be discharged horizontally from 10 nozzles at a velocity averaging 10 fps. Figure 1-6 describes the thermal distribution in Lake Erie.

The use of ten foot spacing between ports will provide an adequate space to avoid jet interference, cross flow effects, recirculation to re-entrainment of warm water in the jets or heat return under current direction changes. Jet dilution will increase when lake water levels are higher than the design water level; the water level chosen for design is conservative because it is the lowest water level ever recorded in the lake.

Submerged, high velocity buoyant jets will achieve in a short distance a low temperature rise in the receiving water body.

The outfall terminus will be composed of a pipe section encased in a concrete block and provided with a plug that can be removed in the future to increase the length of the diffuser in the event that a second unit is installed.

1.6.1.3.3 Pump House

The required make-up water flow of 3300 gpm per unit to be pumped from Lake Erie will be supplied by means of vertical wet pit pumps, each of which will have a design capacity of 3000 gpm and a total head of 150 feet. The pumps will be provided with check and shutoff valves at discharge. In order to protect the pumps and facilitate maintenance, screens and stop logs will be provided if found necessary. The pumps will discharge into a common header that will be encased into a concrete block outside of the pump house.

1.6.1.4 Permanent Onshore Facilities

1.6.1.4.1 Main Plant

The power plant will be a Westinghouse PACE 260 combined cycle package unit ofnominal 250 MW rating enclosed in a steel frame with an insulated steel siding building which will contain all equipment except fuel unloading and storage and a mechanical draft cooling tower. It will be constructed on conventional pile supported mat type foundations which will require a minimum of excavation.

1.6.1.4.2 Cooling Tower

The cooling tower installed with the plant to reject excess heat to the atmosphere will be a multi-cell mechanical induced draft type. It will normally cool 79,000 gpm of circulating water 20F and consume approximately 1400 gpm of water as an evaporative loss. A concrete basin beneath the tower will catch the water falling through the tower fill, provide a limited storage reservoir for circulating water, and form the foundation structure.

1.6.1.4.3 Tank Farms and Fuel Unloading Facilities

The on-site fuel tank farm will consist of two tanks. Both will be 48 by 150 ft diameter tanks which will have a capacity of 6,080,000 gallons each. These tanks will be interconnected and can be filled from multiple unloading stations by tank trucks or by railroad tank cars.

1.6.1.4.4 Switchyard and Substation

The plant will have two main power transformers of approximately 150 MVA each located adjacent to the turbine room. All high side switchyard equipment will be located at the substation. Four 13.8 kv oil circuit breakers and an open bus structure will feed the two main transformers from the combustion turbine generators and the steam turbine generator.

The substation will contain three 115 kv oil circuit breakers, potential transformers, and the associated hardware necessary

to connect the new plant into the existing 115 kv transmission line.

1.6.1.4.5 Access Road

Presently, this site is accessible by means of Pennsylvania Highway Route 5 and the Penn Central Railroad tracks on the southern border. An access road into the site will be constructed in accordance with the State of Pennsylvania Department of Highways approval. All the materials required for the construction, operation and maintenance of this plant will be transported to the site by either truck or by railroad.

1.6.1.4.6 Railroad Spur

It is planned to have a railroad spur enter the site from the existing Penn Central line, which forms a portion of the site's southern boundary. The railroad spur into the site will be constructed in accordance with standards approved by the Penn Central Railroad. During the construction phase, this spur will be utilized for the delivery of large pieces of mechanical equipment such as the combustion turbine, steam turbine, associated electrical generators, transformers, and cooling tower components. During normal plant operations, the railroad will be used for fuel oil delivery.

1.6.2 Operation Phase

1.6.2.1 <u>Operational Plant Modes</u>

1.6.2.1.1 Projected Operation Schedule

A total of 4,000 hours per year of intermittent operation are projected for this plant. This is based on up to 14 hours of use per weekday and only occasional use on weekends.

However, this projected schedule may vary, depending upon the overall system demand for electricity and the ability to fulfill these demands by other existing PJM system generating facilities.

The Lake City combined cycle station will consist of two combustion turbines, two steam generator packages, one steam turbine, three electrical generators, one steam condenser, one cooling tower, plus other supporting components. The combustion turbines can be operated separately when the steam cycle is not available.

1.6.2.1.2 Combustion Turbine Operation

When the plant operates in a simple cycle mode, it will utilize one or both of the combustion turbines to produce

electricity solely by the generators directly coupled to the shaft of each combustion turbine. These combustion turbines will have 17 axial compressor stages and four turbine stages, all attached to a common shaft.

Each combustion turbine will require about 633 lb/sec of air flow. This air will be drawn in through the inlet ducts and compressed as it flows through the various stages of the compressor. As a result of the energy added to the air, the pressure at the exit of the compressor will be approximately ten times the ambient pressure with a corresponding temperature of about 600°F.

The high pressure and temperature air will then enter the combustion chamber of the combustion turbine; and as it flows through the combustion chamber, fuel oil will be sprayed into the air and burned. This process will increase the gas temperature even more, so that the average gas temperature leaving the combustion chamber and entering the turbine will be approximately 1900°F during normal operation. This hot gas will continuously flow through the combustion turbine to the turbine exhaust; but while doing this, the hot gas will impart a large portion of its available energy to turn the turbine which in turn will drive the compressor and the electric generator. The final exhaust temperature will be 950°F.

1.6.2.1.3 Combined Cycle

When this plant is operated in the combined cycle mode, the third generator which will be coupled to the steam turbine, will also produce electricity and thus increase the output of the plant. To accomplish this, fuel oil will be sprayed into the combustion turbine exhaust duct and secondary combustion will take place. This will increase the average temperature of the gases to about 1250°F. These gases will then pass through a steam generator package and flow out of the exhaust stacks. As these gases move through the steam generator, most of the available energy will be extracted by the extended heat transfer surfaces in the steam generator which will reduce the gas exhaust temperature at the stacks to about 300°F. The energy extracted will be used to generate steam. The energy level of the steam at the turbine inlet will be approximately 1250 psia and 950°F.

1.6.2.2 Cooling Tower Operation

A multi-cell mechanical draft water cooling tower will be used in this station. This tower will have induced draft fans, at the top of each cell. These fans will be used to pull air into the cooling tower from the sides and channel it through respective stacks on top of each cell. Meanwhile, water will be pumped to the top of the cooling tower and sprayed down on

to the fill on either side of the tower unit until it reaches the concrete basin of the tower. In doing this, the water droplets will be cooled by the circulating air through forced convection, and by vaporization of a portion of the circulating water.

The cooling tower will be designed to circulate 79,000 gallons of water per minute with a water temperature change of 20 F between the inlet and outlet connections of the cooling tower.

1.6.2.3 Operational Byproducts

1.6.2.3.1 Liquids

Most of the treated effluent of the combined cycle plant will be cooling tower blow down. The maximum blow down is estimated to be 1400 gpm of plant circulating cooling water at a cooling tower concentration factor of 2.* An additional 8.05 gpm of water from the water demineralizer system will be combined with the blow down from the cooling water circulating system. The regenerant will have a PH of 7.0 and contain 8640 ppm dissolved solids and 4430 ppm SO_4. This combined discharge will have characteristics as shown in Appendix C.

All of this treated waste water will be carried to the bottom of the lake in an outfall pipe for discharge through ten diffuser nozzles.

1.6.2.3.2 Gases

The fuel used in the combustion turbines, as well as the auxiliary burners installed with the heat recovery boiler, will be ASTM No. 2 fuel oil. This is a distillate oil with a sulfur limit of 0.5 percent by weight and very low concentration of other contaminants.

The emission from the stacks of this plant will consist of NO_x, SO_2, and particulates. The source of these emissions would be attributed to the contaminants in the fuel, the products of combustion, and a very small percentage of unburned fuel.

The exhaust gas from the stacks will be about 300 F during normal mode of operation when this plant operates as a combined cycle; but in an emergency, the combustion turbines in this plant can operate by themselves with the steam generator dry; and in such an event the maximum exhaust gas temperature at the stack will be about 900 F.

* Concentration factor refers to the amount of solids per unit volume of circulating water in the cooling tower over the amount of solids per unit volume of lake water. This is caused by evaporation in the cooling tower which concentrates the solids in the circulating water.

1.6.2.3.3 Solids

Presently, the only solid waste anticipated will be dewatered sludge from the waste water treatment system of this station. The rate of accumulation of this waste as estimated will be 1.5 cubic yards per 24 hours of operation.

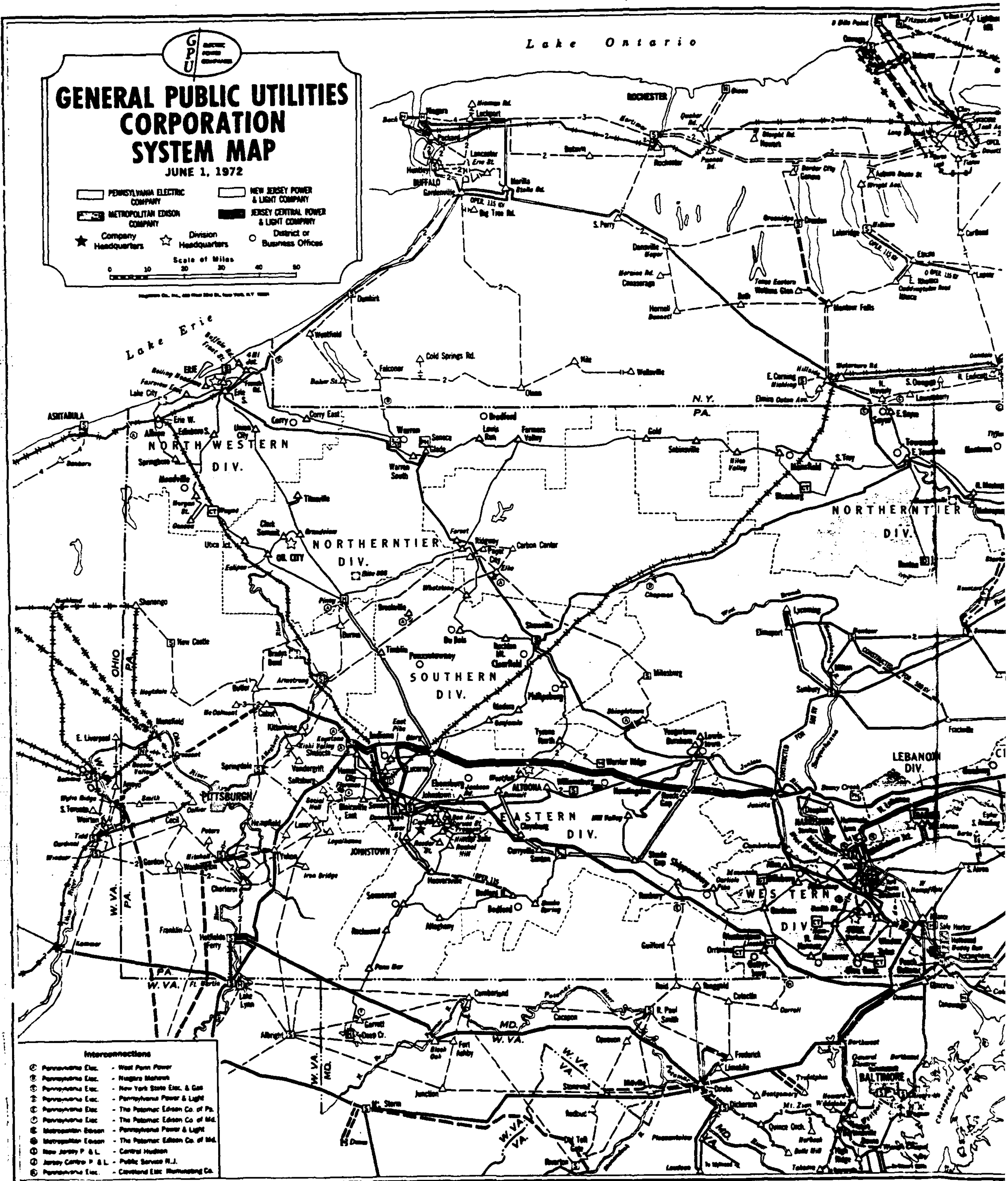
This waste will be collected in closed containers and will be removed from the station for disposal in certified sanitary land fills owned and operated by others.

1.6.2.4 Plant Traffic

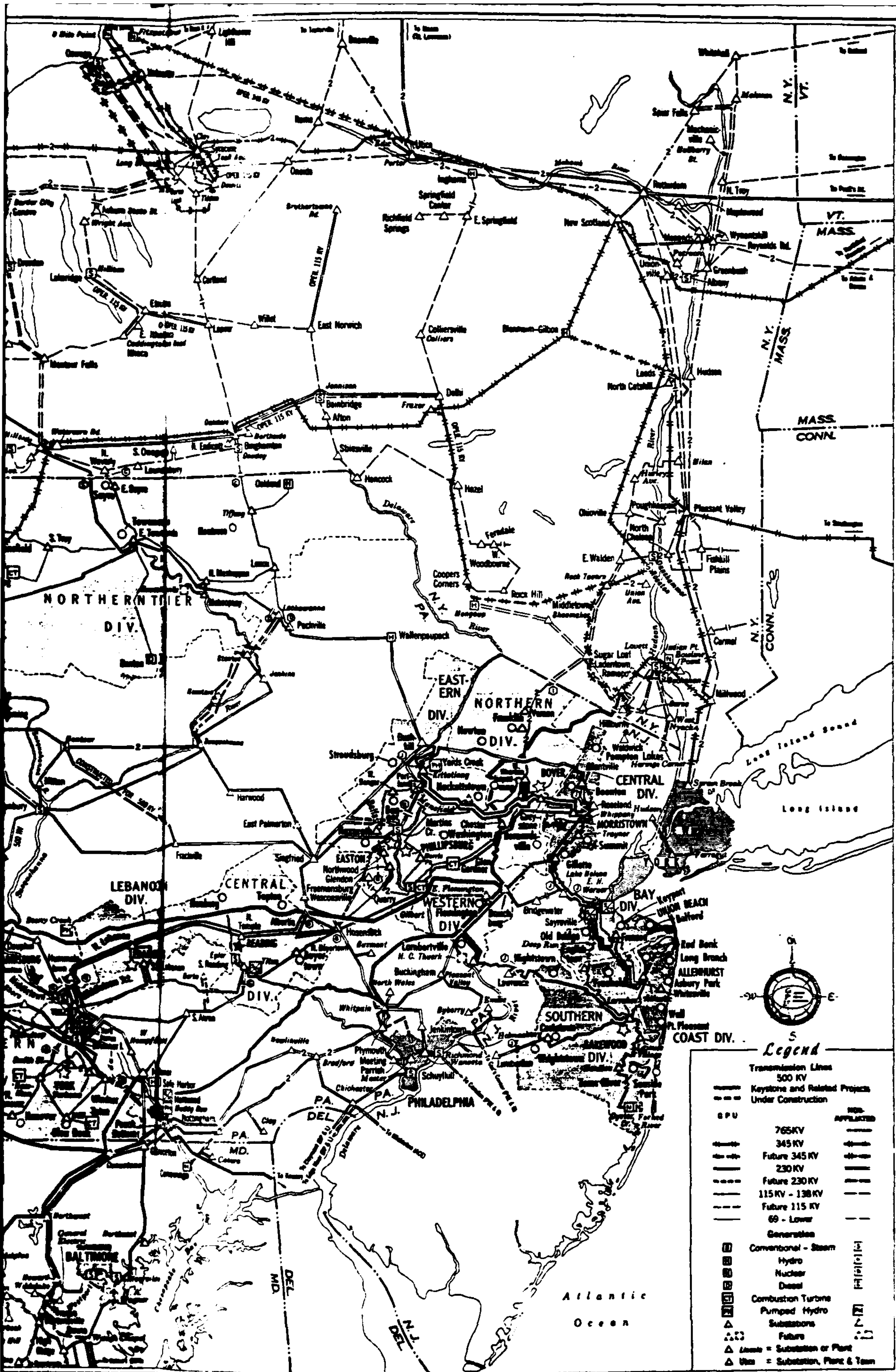
Highway traffic will be minimal because the Lake City Plant requires as few as 3-5 persons per shift for operation and maintenance during normal conditions. In the event that a major overhaul is being performed in the plant, it is predicted that as many as 35 persons can be working on the station at one time.

Present design calls for a rail fuel oil delivery system to deliver and unload 50 tank-car loads of fuel per week. These tank-cars have a capacity of 23,500 gallons. Present planning requires that 10 car loads of fuel oil will be delivered to the station during each week day and that no fuel oil will be delivered or unloaded during the weekend.

A supplementary truck unloading facility will be included in the fuel unloading system, but the truck unloading system will serve only as a backup in the event that rail delivery is not feasible.



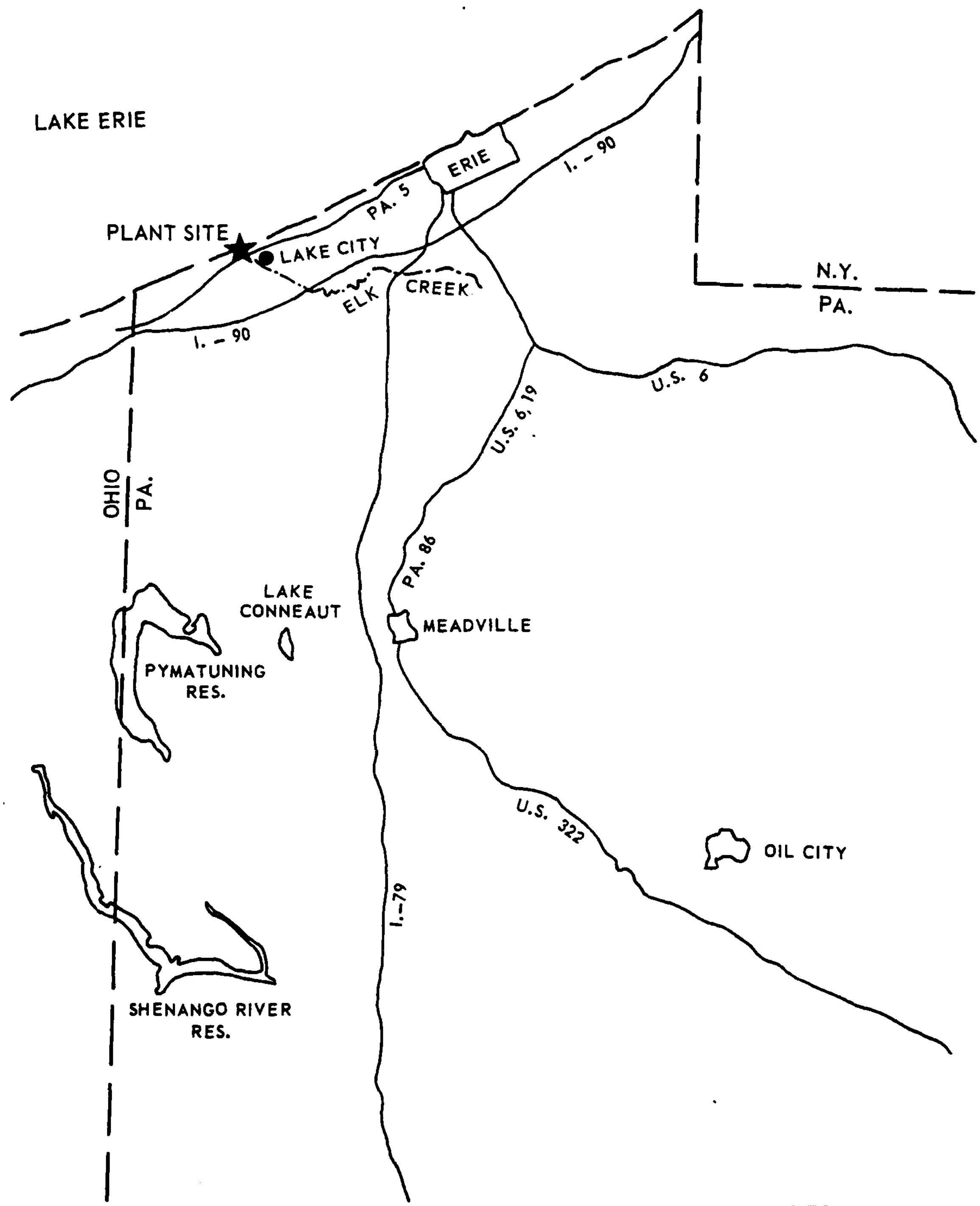
GENERAL PUBLIC UTILITIES
CORPORATION
SYSTEM MAP
JUNE 1, 1972
PENNSYLVANIA ELECTRIC COMPANY
NEW JERSEY POWER & LIGHT COMPANY
METROPOLITAN EDISON COMPANY
JERSEY CENTRAL POWER & LIGHT COMPANY
Company Headquarters
Division Headquarters
District or Business Offices
Scale of Miles
0
10
20
30
40
50
Lake Ontario
Lake Erie
NORTH WESTERN DIV.
NORTHERNTIER DIV.
SOUTHERN DIV.
EASTERN DIV.
WESTERN DIV.
LEBANON DIV.
N.Y.
PA.
OHIO
W. VA.
MD.
VA.
ROCHESTER
BUFFALO
ERIE
ASHTABULA
OIL CITY
PITTSBURGH
JOHNSTOWN
ALTOONA
BALTIMORE
Interconnections
Pennsylvania Elec. - West Penn Power
Pennsylvania Elec. - Niagara Mohawk
Pennsylvania Elec. - New York State Elec. & Gas
Pennsylvania Elec. - Pennsylvania Power & Light
Pennsylvania Elec. - The Potomac Edison Co. of Pa.
Pennsylvania Elec. - The Potomac Edison Co. of Md.
Metropolitan Edison - Pennsylvania Power & Light
Metropolitan Edison - The Potomac Edison Co. of Md.
New Jersey P & L. - Central Hudson
Jersey Central P & L. - Public Service N.J.
Pennsylvania Elec. - Cleveland Elec. Illuminating Co.



NORTHERN TIER DIV.
EASTERN DIV.
NORTHERN DIV.
CENTRAL DIV.
LEBANON DIV.
CENTRAL DIV.
WESTERN DIV.
BAY DIV.
SOUTHERN DIV.
COAST DIV.
LAKEWOOD DIV.
MORRISTOWN
EASTON
PHILLIPSBURG
PHILADELPHIA
BALTIMORE
READING
UNION BEACH
ALLENHURST
Red Bank
Long Branch
Asbury Park
Pt. Pleasant
Long Island Sound
Long Island
Atlantic Ocean
N.Y. VT.
VT. MASS.
N.Y. MASS.
MASS. CONN.
N.Y. CONN.
PA. DEL.
PA. MD.
N.J. DEL.
DEL. MD.
Legend
Transmission Lines
500 KV
Keystone and Related Projects
Under Construction
GPU
NON-AFFILIATED
765KV
345KV
Future 345KV
230KV
Future 230KV
115KV - 138KV
Future 115 KV
69 - Lower
Generation
Conventional - Steam
Hydro
Nuclear
Diesel
Combustion Turbine
Pumped Hydro
Substations
Future

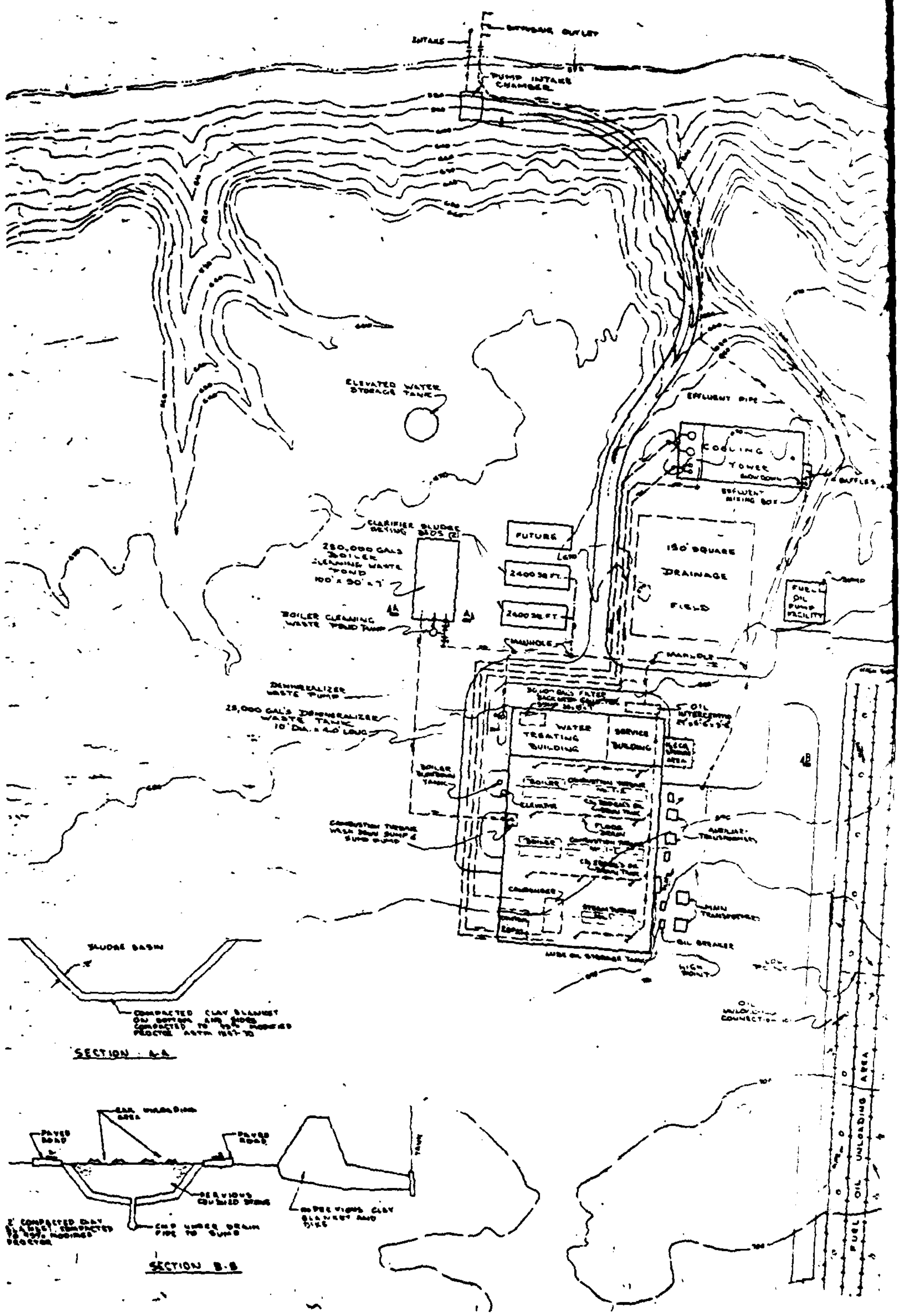
2

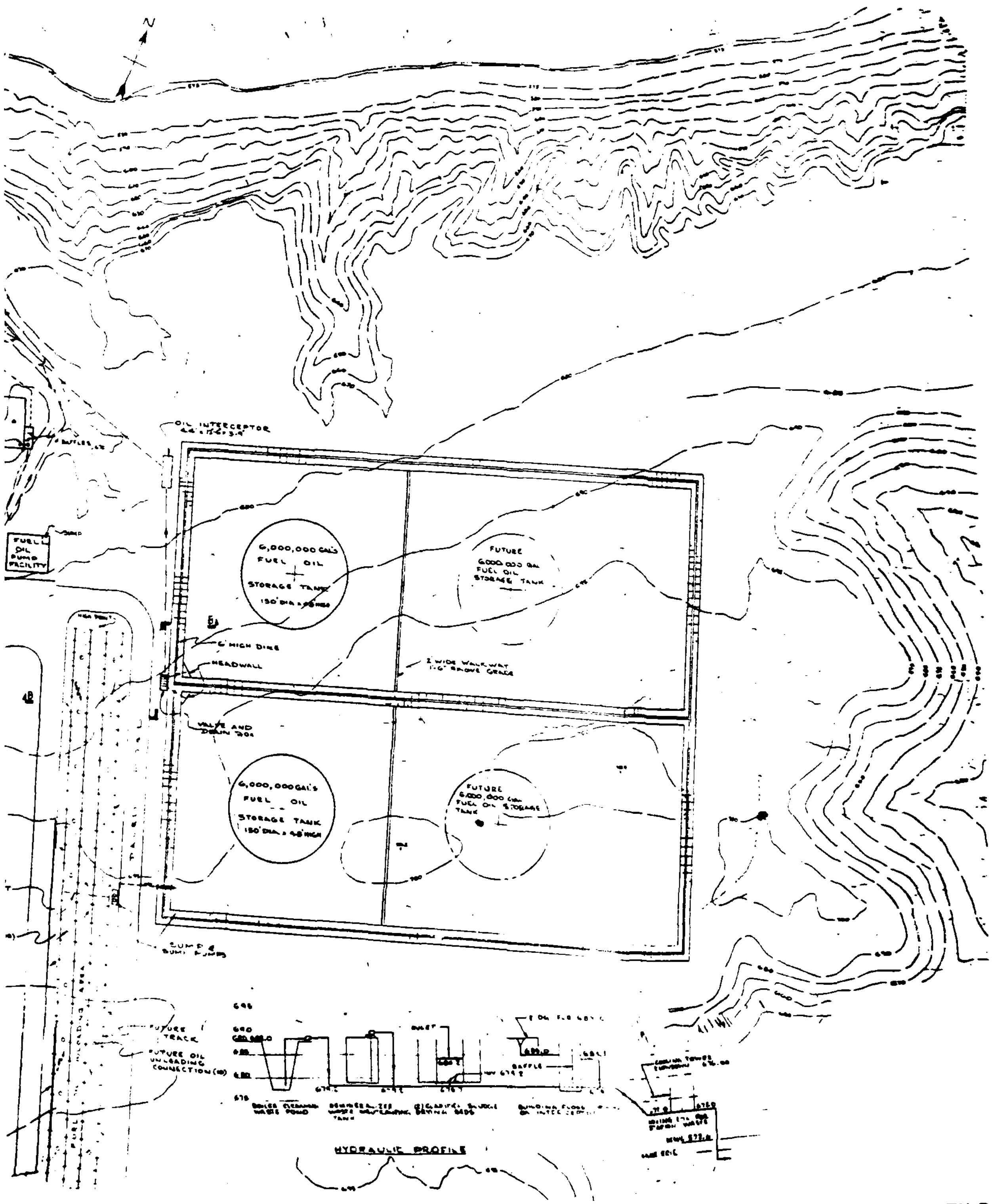
PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



SITE LOCATION
FIGURE 1-2

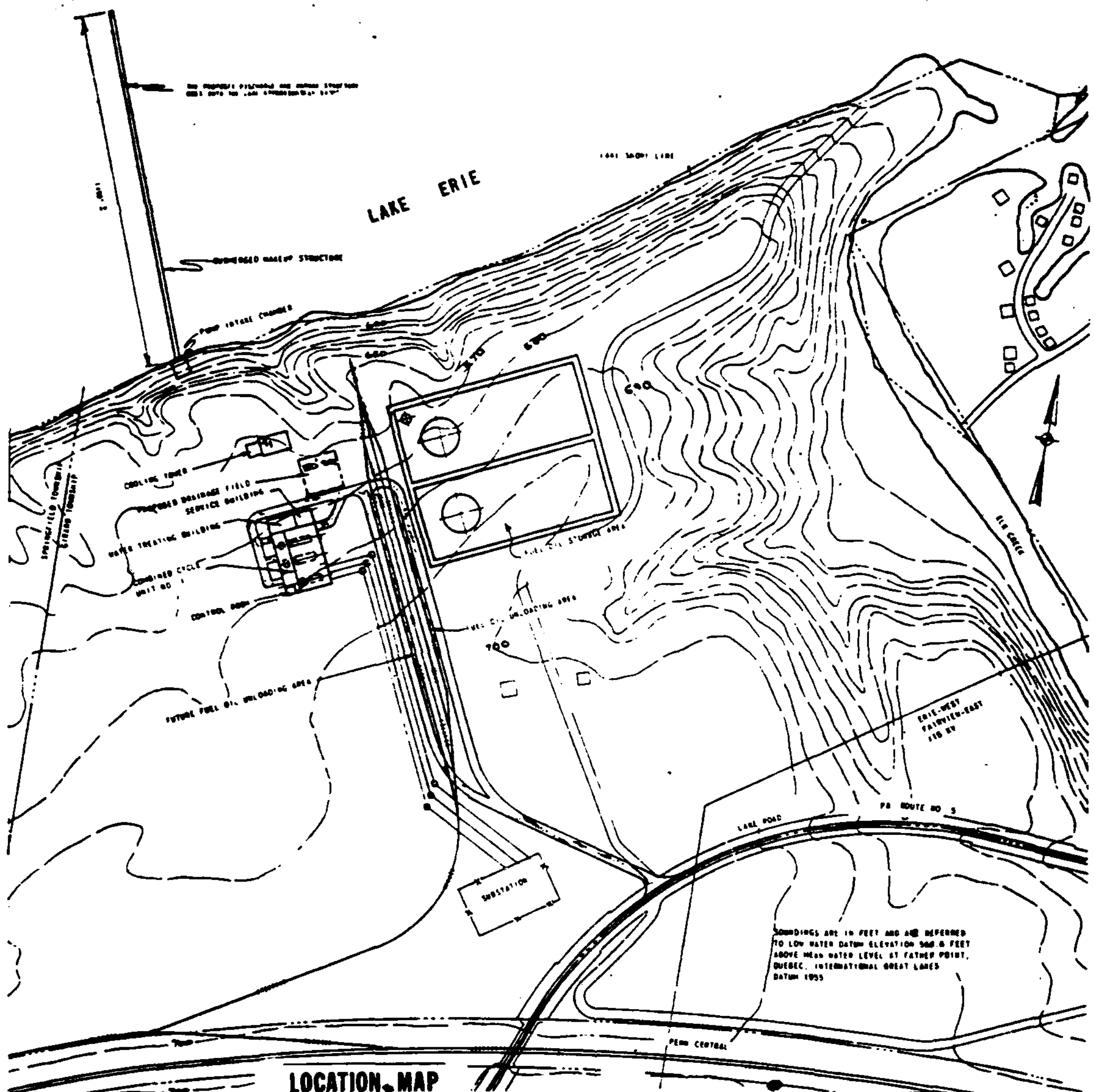
PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



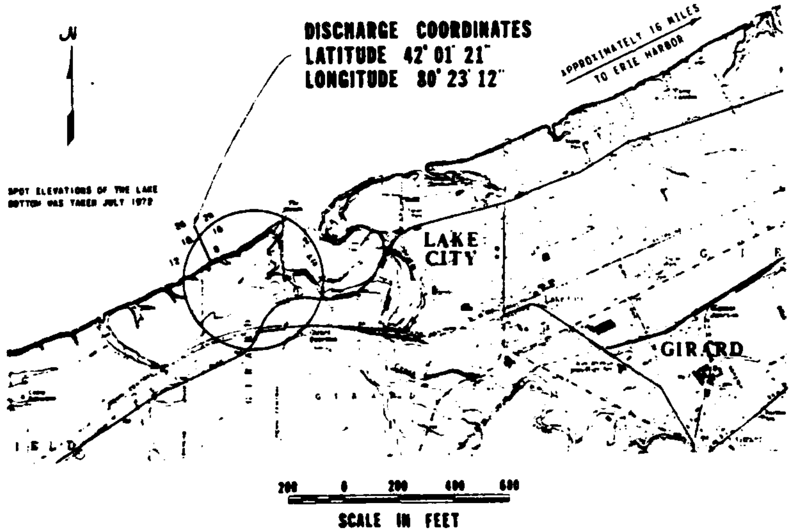


LAKE CITY PLANT
PLOT PLAN
FIGURE 1-3

2



LOCATION MAP

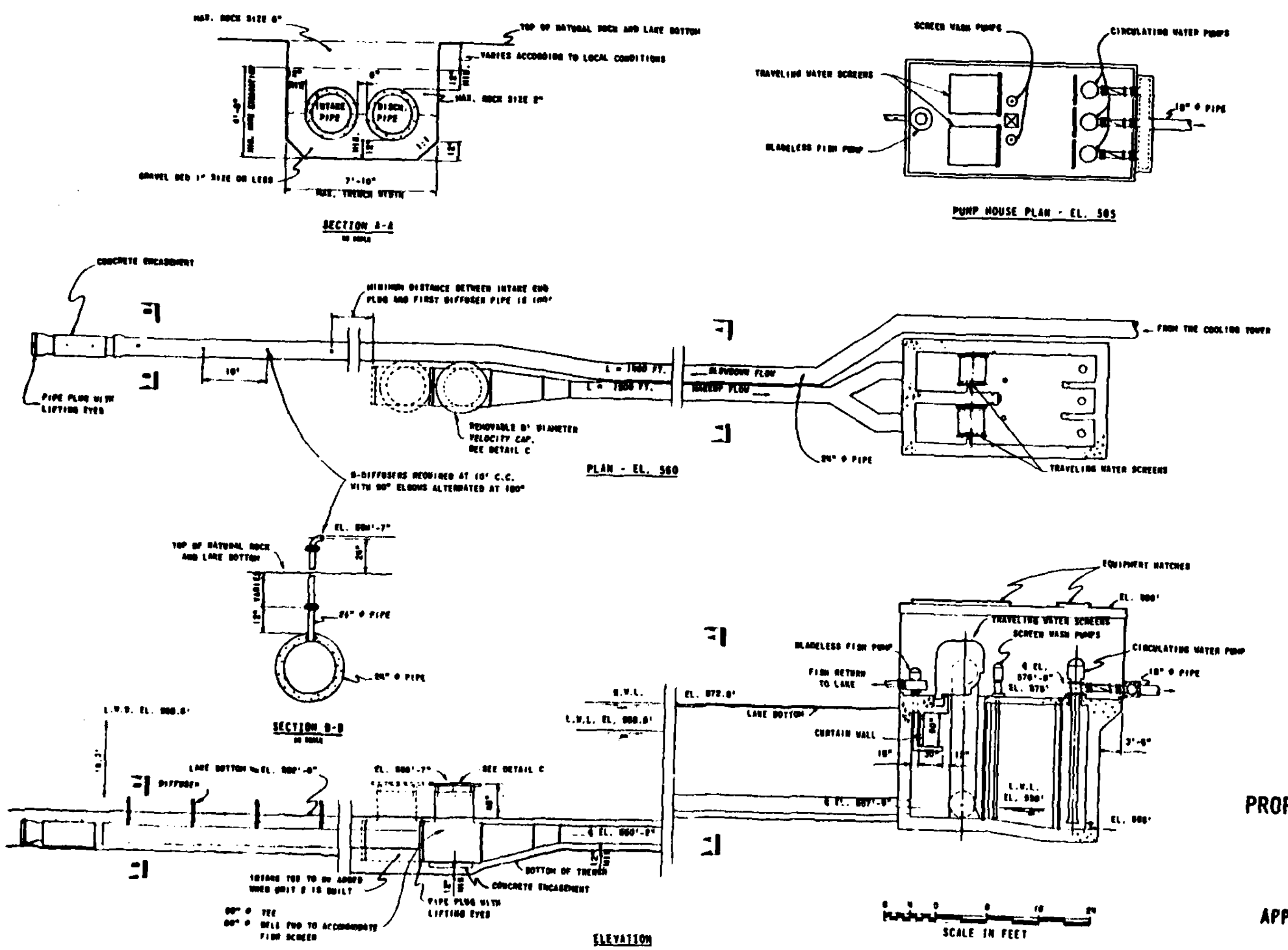


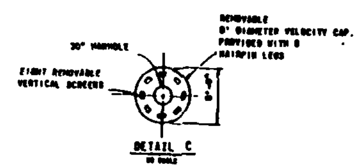
PROPOSED INTAKE AND OUTFALL STRUCTURE

IN LAKE ERIE AT GIRARD TOWNSHIP
ERIE CO., PENNSYLVANIA
APPLICATION BY: PENNSYLVANIA ELECTRIC CO.

JULY 12, 1972 SHEET 1 OF 2
REV. 1 JAN. 22, 1973

FIGURE 1-4





ELEVATIONS ARE IN FEET ABOVE MEAN WATER LEVEL AT FATHER POINT, QUEBEC. INTERNATIONAL GREAT LAKES DATUM 1955

PROPOSED INTAKE AND OUTFALL STRUCTURE

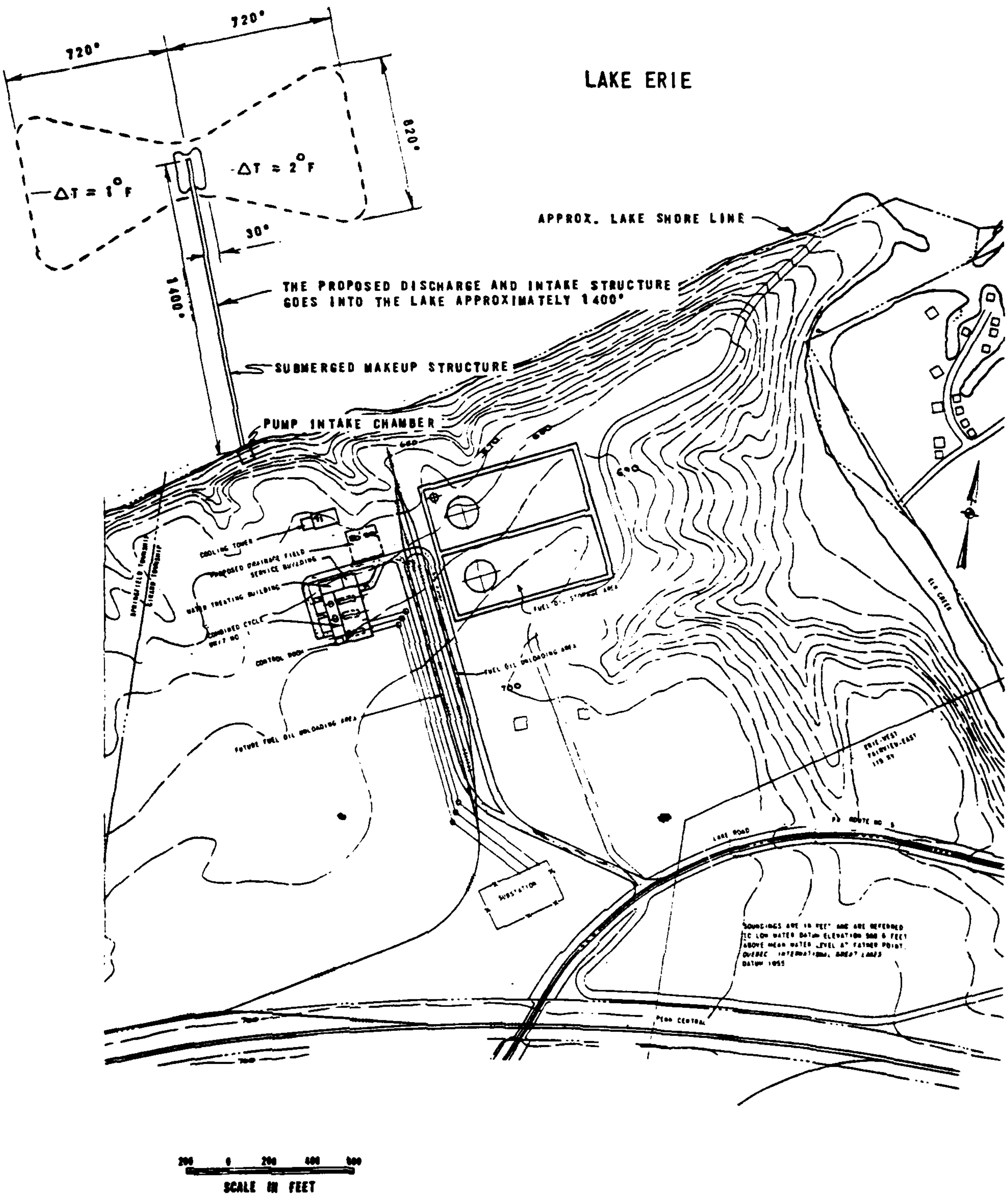
IN LAKE ERIE AT GIRARD TOWNSHIP
ERIE CO., PENNSYLVANIA
APPLICATION BY: PENNSYLVANIA ELECTRIC CO.

JULY 12, 1972
REV. 1 JAN. 22, 1973
REV. 2 SEP. 4, 1973

SHEET 2 OF 2

FIGURE 1-!

PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



WASTE EFFLUENT MIXING ZONE
FIGURE 1-6

2. ENVIRONMENTAL SETTING WITHOUT THE PROJECT

2.1 SITE LOCATION AND TOPOGRAPHY

The Lake City site is located in Girard Township, Erie County, Pennsylvania, one mile west of the town of Lake City and consists of approximately 639 acres. It is bounded by Lake Erie on the north, Elk Creek on the east, and Pennsylvania Route 5 (LR 496) on the south (see Figure 1-2). The Penn Central Railroad passes through the southwest corner of the property.

The site is located in the Eastern Lake Section of the Central Lowland physiographic province on the lake plain. The lake plain extends from the lake level (mean elevation 572 feet) upward to approximately 800 feet. It is interrupted at places by abrupt rises of former beach ridges which represent previously higher elevations of the lake surface. The Lake City site is situated between the present lake bluff or escarpment and a former beach ridge.

The major topographic elements of the site are two escarpments; one paralleling the Lake Erie shoreline, and one bordering Elk Creek. The Lake Erie escarpment extends throughout most of Erie County but reaches its maximum height of 120 feet at the site area with a minimum slope of 30 percent. At the site it is cut by a few steep sided ravines. The escarpment bordering Elk Creek is also approximately 120 feet high but the areal extent is greater due to its gentler slope. The land surface above the escarpments, slopes gently from the former beach ridge toward the lake escarpment.

Land usage on the lake plain includes farming, residential, recreational, and some commercial. Farming consists of commercial nurseries specializing in evergreen shrubbery, vineyard and orchard fruits, and certain vegetables. Lake City Boro (1,722) and Girard Boro (2,451) occupy positions on the lake plain. Some industrial concerns are located within these boroughs or within Girard Township but none are located near the lake escarpment. Recreational facilities are located at points along the lake shore and are primarily used for boating and fishing. Elk Creek, bordering the site, is a major trout stream. Boating facilities and summer cabins are located on the east side of Elk Creek at its mouth. South and west of the site area, farming predominates.

Soils at the Lake City site have developed upon glaciolacustrine sediments of Quaternary Age. They consist of dune sands and fine sandy loam to loamy fine sand (Reference 2-1).

Approximately 60 percent of the area is covered with mixed hard woods and conifers, however, the immediate proposed plant site is basically open fields.

Figure 2-7 is an aerial photograph of the site area, taken on March 27, 1972, on which an overlay has been made to show the plant building, fuel tanks, cooling tower. substation, pump-house, railroad and road access, in the planned locations. This is an aerial photograph which shows that the plant will be in an unwooded area and demonstrates that there will be little need to remove trees or other vegetative cover in the development of the site and the construction of the plant.

2.2 GEOLOGY

In general, bedrock in the area consists of 6000 to 7500 feet of essentially flat lying, sedimentary rock above crystalline igneous rock of pre-Cambrian age. Bedrock at the site consists of very thin alternating layers of gray shale and fine grained gray sandstone which belongs to the Canadaway Formation of Upper Devonian Age. It outcrops at a mean elevation of 578 feet along portions of the lake shore and Elk Creek. Bedrock appears to have a horizontal orientation but in reality it dips south to southwest at 15 to 20 feet to the mile. A regional geology map and generalized geologic cross section are shown in Figure 2-5. Core borings have been made at the site and are summarized in Figure 2-8 and Tables 2-11 and 2-12.

Events of geologically recent glacial episodes have greatly influenced the area. During 4 major periods of glaciation, advancing ice scoured and smoothed the landscape over which it passed absorbing and abrading large quantities of rock material as it moved southward. Retreating ice deposited the accumulated debris and created large volumes of water much of which became impounded due to disruption of previous drainage systems. Lake Erie formed in a scoured basin along the front of the receding glacier into which sediments were deposited by the melt waters. Water levels of the lake were controlled by the elevation of outlets leading to the sea. Continued ice retreat to the north and east opened successively lower outlets which lowered the level of the lake in the Erie basin to its present elevation.

The Lake City site is situated on an approximately 110 foot sequence of glacial sediments consisting of lacustrine deposits and till. This sequence of glacial drift is exposed in the escarpments bordering the site. Generally the surficial geology of the site consists of dune sands and beach deposits at the surface in the fields with water sorted lacustrine sands in the wooded areas. The deposits extend to a maximum depth

of approximately 25 feet. Below this material occurs gray very fine sand exhibited as rhymites on the lake escarpment. Clarity of the rhymites diminishes with depth. This material is basically nonplastic and moist except where exposed. A till-like material occurring above bedrock was observed to range in thickness from 10 to 30 feet. It is a very dense material and consists of an unsorted mixture of clayey silt, sand, and some rock fragments. A shingled beach is exhibited along portions of the lake shore which is constructed by wave action piling flat cobble size rocks in succession.

2.3 LAKE BOTTOM SURVEY

Starting from the proposed shore line out to 2000 ft into Lake Erie on a bearing of 340°, Figure 2 - 6 gives the bottom profile and all conditions presently existing on the site.

a. Station 1

Starting at the 1600 ft distance from the shore line and working toward the point of entry on the proposed beach site, the depth is 26 ft with the water level at elevation 572.3 ft as indicated in Figure 2-6 which is a bottom profile from the lake survey.

The bottom is shale with some broken shale lying on top of hard bottom with a very thin cover of fine sand. The area is clear with no bottom movement, which indicates a freedom from problems such as algae and sand entering the intake or bottom movement interfering with the drawing of clean water. Upon rechecking one week after the initial inspection and high winds, the area in question was found to be stable with no change in bottom conditions.

b. Station 2

Moving in toward shore, the area is still stable with a shale bottom and a very light sand that does not cover the bottom. There is some loose scattered shale stone, on top of a hard bottom. The shale bottom is very hard; and although pressure cracks show all across the bottom, the situation is natural and very stable. Moving southward 200 ft, the depth decreases to 24 ft in a very moderate grade. The area has some clay silt which is very spotty and the water condition is clear.

c. Station 3

In the next 200 ft area nearer the beach, the bottom continues to have a very slight grade, with the depth

decreasing to 22.5 ft. The bottom continues to be same as area 2 with the exception that there is slightly more sediment settling mostly in low pocket areas.

d. Station 4

Moving inward to the next 200 ft area, the depth decreases to 18 feet. This depth shows little bottom movement; however, bottom movement could occur during heavy winds with high waves of 10 to 12 ft, and extreme weather would move stone on the bottom.

The area has light sediment on top of small stones which are round and hard. There are also some flat rocks with a few large boulders 5 to 8 ft wide. The configuration of the area has some low spots and high spots but generally shows a gradual incline to the beach.

e. Station 5

The incline continues to be gradual thru to the next 200 ft moving to a depth of 13.5 ft. This area shows some bottom movement, has very little sediment, is very flat with a shale bottom, and has sand moving eastward through its depth. Signs show that light sand moves in and across the area at a continous rate but with no evidence of more than one to two inches at any time.

There are no stones or boulders in this area and the shale contains cracks and is very hard. Some clay sediment is found in this area but appears to have been washed from the shore area.

f. Station 6

Both Stations 5 and 6 are very flat with the depth not changing more than 6 inches in 400 ft to reach this area depth of 13.0 ft. Bottom conditions continue to run the same as Station 5 with the exception that more sand and sediment is found generally in low pocket areas in the shale. The presence of some small gravel is indication of some backwash from the beach.

A very light growth of algae in this area is some indication that the area is relatively clean, since its presence also shows that the light penetration is sufficient to allow the growth of the algae.

g. Station 7

The bottom rises 3 ft in a gradual grade through the 200 ft of Station 7 to the area depth of 10 ft and has the same

general bottom conditions as Stations 5 and 6.

The shale is still the flat hard type mentioned throughout the survey. This area has mostly fine lake sand which is never more than 1 to 2 inches deep and is continuously moving eastward across the area. Because of the predominant west to east weather, this movement is always prevalent in this area.

h. Station 8

At Station 8 in the survey the depth decreases to 7 ft which is 3 ft less than Station 7. The grade continues to be gradual as noted at all other areas. Bottom conditions show that hard flat shale is predominant in the area. Station 8 contains the highest amount of fine sand in the entire survey with the depth varying from 3 to 4 inches.

Stations 7 and 8 are the main bottom movement areas with 95 percent of all such movement occurring here. There are approximately 80,000 to 100,000 cubic yards of sand moving through this area every year. This sand moves from west to east and accumulates at the Erie Presque Isle Peninsula. The sand moves at a rapid rate or slow rate according to the severity of the weather coming from the predominant west. The estimate of sand moving through the area comes from a test made by the Corps of Engineers study on replenishment sand for Presque Isle Beach at Erie, Pa.

During heavy weather, winter or summer, this area would be very hard to control. Any construction must be below bottom surface with back fill kept at the bottom surface level, since any construction or backfill above this level would be carried away by the force of wind and wave action in summer and by gouging ice plus wave and wind action in winter.

i. Station 9

From Station 8 the survey moves into the beach area. The bottom continues to be hard shale with the grade sloping from 7 ft at Station 8 to 1 foot at the beach. The beach area is course sand mixed with flat shale and sandstone rocks in a mixture composed of about 50 percent sand and 50 percent stone.

The beach width from the waters edge to the cliffs is 12 to 14 ft varying because of the weather and water wear against the shale bank of the cliffs. The beach is a continously changing area due to the high impact of heavy seas and erosion of the lake bank. This area can change

from week to week or day to day depending on the severity of the weather.

j. Station 10

This area is lake bank which leads from the beach to the level surface where construction of the project is located. The bank is very steep with shale extending from beach bottom upward to 15 to 20 feet. From the extension of the shale to the top, the bank consists of a very wet blue clay which is very unstable. The only factors retaining the bank are the heavy tree growth and vegetation on the bank. Should any of the trees be cut, the bank would erode and collapse in a very short time. Heavy rain or steady rain could soften the bank and cause a waterlike flow.

2.4 SEISMICITY

The site lies near the border of Zone 3 and Zone 2 of the 1969 U. S. Coast and Geodetic Survey Earthquake Probability Map. Zone 2 is described as a zone in which damage would be moderate, while Zone 3 is described as a zone of major damage. However, the Coast & Geodetic map showing the epicenters of earthquakes throughout the United States through 1963 shows only 2 epicenters within fifty miles of the site. Both are designated as having intensities of V-VI on the Modified Mercalli scale. One epicenter was approximately 10 miles NE from the site under Lake Erie. This quake was felt only locally and occurred October 29, 1934. The other was approximately 40 miles N.W. from the site under Lake Erie.

The major historical earthquake affecting the site would probably have been the Attica, N.Y. earthquake (110 miles from the site) on August 12, 1929, which has been rated as a M.M. Intensity of VIII. It is estimated that this quake would have been attenuated to a M.M. Intensity of V-VI or less at the site.

It should be noted however, that seismicity is not a critical factor for the proposed power station because the plant will be designed in accordance with all applicable building codes and will thus have the structural integrity inherent in these codes. A consulting A-E firm has been employed to ensure that plant design will be in accordance with all applicable building codes and good engineering practice.

2.5 HYDROLOGY

2.5.1 Present Water Quality and Use

The composition of the present Lake Erie water is given below. Samples were taken at 1000 ft, 1500 ft, and 2000 ft from the shoreline at the plant site, west of the mouth of Elk Creek.

Water samples were collected over a period from February to May 1972. They were taken from Lake Erie, west of the mouth of Elk Creek at distances offshore ranging from 150 feet to 2000 feet. They are representative of what would be received at the planned plant intake during that period. Table 2-13 gives the laboratory analyses for these several samples. These analyses were reviewed for the purpose of establishing design criteria for the water treating plant and the waste treating facilities. The following analysis is a synthesis which was used for design:

		$CaCO_3$ Equivalents	Ions
Calcium	ppm Ca	86.0	34.4
Magnesium	ppm Mg	36.2	8.8
Sodium	ppm Na	51.9	23.8
Total Cations	ppm	174.1	
Bicarbonates	ppm HCO_3	91.9	112.2
Sulfates	ppm SO_4	34.4	33.0
Chlorides	ppm Cl	42.2	30.0
Nitrates	ppm NO_3	5.6	7.0
Total Anions	ppm	174.1	
Hydrogen Ion Conc.	pH		8.1
Conductivity	mmho		338
M.O. Alkalinity	ppm $CaCO_3$		91.9
Total Hardness	ppm $CaCO_3$		122.0
Free Carbon Dioxide	ppm CO2		0
Silica-Soluble	ppm SiO_2		3.5
Iron-Soluble	ppm Fe		0.1
Iron-Total	ppm Fe		0.40
Manganese-Total	ppm Mn		0.11
Iron & Alum. Oxides	ppm R_2O_3		0.3
Color			10
Turbidity			5
Suspended Solids	ppm		11
Soluble Solids	ppm		190
Total Solids	ppm		201

The pattern of water use, both consumptive and non-consumptive, may be viewed as follows. When the plant is operating at full load, 3300 gpm of water will normally be drawn from the lake; 2800 gpm of this will be pumped to the cooling tower; 1400 gpm will be evaporated in the cooling tower and lost to the near atmosphere; 1400 gpm will be returned to the lake from the cooling tower in order to maintain a satisfactory concentration

ratio in the tower loop. The remaining 500 gpm will be clarified and filtered: of which 150 gpm will be allocated to demineralizer feed for make up to the plant steam cycle, the remaining 350 gpm will be for potable uses and filtered water needs. The normal usage of water for these latter functions will be much less than 500 gpm. Of the 500 gpm (maximum) the only true consumption will be the evaporation to atmosphere from minor steam and water leakages in the plant and the sludge that will be hauled away to a State-approved landfill. All other water used will ultimately return to the lake. These demands only arise when the plant is in operation. When the plant is unloaded, there will be no evaporation or blow-down from the cooling tower and the plant usage is unlikely to exceed an average of 100 gpm.

2.5.2 Groundwater

Groundwater in the area appears to be perched on the gray very fine sandy silt to silty very fine sand. Groundwater levels as observed in the test holes ranged from elevation 686 to elevation 659 with the piezometric surface sloping to the northwest. Recharge to the groundwater table is basically through infiltration of precipitation. Fluctuations in the groundwater table can occur rather quickly after a heavy rain due to the rapid permeability of the near surface soil.

At several points the groundwater table intersects the surface resulting in springs, seeps, and woodland swamps.

Well yields in the surrounding area are small from both glacial deposits and bedrock. Generally this water is mineralized and hard with some bedrock wells encountering sulfurous water, brines, and natural gas.

2.5.3 Soils

Soils at the Lake City site have developed upon wind and wave sorted glaciolacustrine sediments. The entire property contains the following soil series as mapped by the USDA, Soil Conservation Service: Dune sands, Escarpments, Ottawa, Conotton, Berrien, Canadice, Wayland, Beach & River Wash, Sloan, Fredon, and Wausean. These soils range from fine sandy, to silty loam, to loamy fine sand. At the proposed plant site four soil series are found: Dune sand, Ottawa fine sandy loam to loamy fine sand, and Wausean fine sandy loam, and Escarpment soils.

Mr. James Granaham of the Erie County Department of Health, in a site visit described the area for an on-site septic

system as belonging to the Conotton series, which is generally deep, well drained, and moderately medium to coarse textured. A test pit dug in this area revealed locally strong mottling with a slight hardpan at a depth of 3 feet formed from accumulated iron oxides. This condition somewhat impedes vertical percolation of infiltrating water.

Mr. Gerald J. Latshaw, Pennsylvania Soil Scientist, was contacted regarding the soils at the Lake City site. Information from his office suggested an on-site investigation for the majority of the proposed plant site. This investigation has been conducted and is discussed herein under 2.2 Geology.

2.6 AQUATIC ECOSYSTEM

2.6.1 Physical-Chemical Characteristics

The physical and chemical qualities of a body of water determine the composition of its biological community. Individual organisms are directly affected by the quality of that part of the environment which sustains life functions, and indirectly affected by an environment which changes and which may affect food organisms. Populations of organisms depend on factors affecting reproduction, which include fitness of individual members, sites of reproduction, temperature, and light. These determining factors may change with time under natural conditions, effecting responding changes in the aquatic biota. The effects of naturally occurring physical and chemical factors on aquatic life have been studied to some extent, and are predictable within limits. These factors and the dependent communities therefore may be used to classify bodies of water.

The proposed power plant site is located in the eastern end of Lake Erie's central basin. The southern shore area of the Lake is shallow and the lake bottom slopes gently. A wave-cut shore cliff exists between Conneaut, Ohio, and Erie, Pennsylvania. Periodic wind-driven currents of varying velocity run along the shore generally from southwest to northeast.

Surface water temperatures of the lake range from the low to mid 30's in winter to the high 70's to low 80's in summer. At the City of Erie, temperatures ranged from about 33 F to about 80 F for surface water in one year (Reference 2-5).

The central basin becomes stratified in summer. The thermocline (region where water temperature drops at least 1 C/1m.) for one year descended to a depth of 15 meters in June (Reference 2-3). The existence of a thermocline in a lake is important for aquatic life because the differences in water

density due to temperature prevent complete circulation of water. This prevents circulation of nutrients to the top water layers and circulation of dissolved oxygen to the bottom layers.

However, wind-driven currents circulate water in the layers above the thermocline (epilimnion). Water temperatures here may vary by only a few degrees. Dissolved oxygen (DO) in the epilimnion remains high. DO levels at the City of Erie ranged from about 7 mg/l to above 13 mg/l for surface water (Reference 2-2). This is well above minimum recommended limits for sensitive aquatic forms, such as salmonid (Reference 2-4). The epilimnion of Lake Erie remained saturated with dissolved oxygen during summer.

The thermocline does not significantly affect temperatures and dissolved oxygen close to the proposed plant site. The water temperature remains fairly uniform to depths of about 50 feet along the southern shore (Reference 2-5).

The lake remains ice-covered along the southern shore during the winter. The slush-ice cover that forms, protects the shore from erosion during winter months and reduces light which can be used for photosynthesis by aquatic plants. The ice cover remains closed even where industries currently discharge thermal effluent.

The lake bottom offshore of the proposed site is sand, clay, and mud with bedrock and gravel (Reference 2-5). Some sedimentation exists along the shore due to erosion and silting.

The water pH and turbidity are within acceptable ranges for aquatic life (References 2-2 and 2-6). Concentrations of nitrate and phosphate have increased since 1900, a condition possibly responsible for increased nuisance algae growth.

2.6.2 Biological Characteristics

2.6.2.1 Plankton

These are organisms that are generally free-floating and microscopic. Changes within the Lake Erie plankton communities have been recorded within the past 40 years. Generally, for the entire lake, the phytoplankton (plants) have become more abundant than before. The dominant populations have changed from diatoms to blue-green algae. Periods of dense plankton populations (blooms) have been recorded for some blue-green and green algae (*Aphanizomenon*, *Anabaena*, *Cladophora*) in the central basin (Reference 2-7). *Cladophora*, a filamentous green alga, grows densely on rocky substrates, but growth is restricted to the upper few meters in shallow areas. This

alga has caused nuisance by fouling some shallow water intakes.

Plankton populations may vary with local conditions, such as temperature, wind direction and current, within a body of water. The data on Tables 2-1 and 2-2 indicate the same broad trend for phytoplankton populations at Conneaut, Ohio, and on the lakeward side of Presque Isle, Erie, for 1970. Diatoms were most abundant in January, February and December, followed by green algae which were abundant in June and July. Blue-green algae became most abundant in late summer. This is a typical pattern for freshwater phytoplankton populations in a north-temperate climate.

With the steady southwest to northeast current between Conneaut and Erie, the plankton found at Conneaut might be expected offshore at the power plant site, barring local influences such as upwellings.

Zooplankton have increased in number within the past 40 years at the City of Cleveland (Reference 2-7). The zooplankton found at the City of Erie (see Table 2-3) belong to groups common to freshwater habitats.

Numbers of planktonic crustaceans found in the central basin of Lake Erie in 1967 are given in Table 2-3. Cyclops spp., Bosmina sp., and Daphnia spp. were most abundant. Table 2-4 lists total numbers of zooplankton per ml found in Lake Erie off of Presque Isle in 1972.

2.6.2.2 Benthic Organisms

The benthic community of Lake Erie varies with location. In the western basin dominant benthic forms have changed since 1900 from species of clams and mayflies to species of midge-fly larvae, clams, and round worms are most numerous. Of the amphipods that are present, Pontoporeia sp. is most sensitive to dissolved oxygen content, and is found largely in well-oxygenated water.

Bottom samples taken from a rock bottom at Conneaut, Ohio contained Amphipoda, Ephemeroptera, Tricoptera, Plecoptera, Chironomidae, Tubificidae, Prosobranchia, Pulmonata, Turbellaria and Bryozoa (Reference 2-2).

A series of benthic samples were taken offshore in Lake Erie during spring, summer and fall of 1963-1964 (Reference 2-3). A collection taken about one mile west of Presque Isle contained 542 organisms per square meter, including mainly Tubificidae, Tendipedidae, Sphaeriidae, and Menatoda. A station several miles west of Presque Isle yielded 1717 organisms per square meter, including mainly those found at

the first-mentioned station. Collections near Conneaut contained 483 organisms per square meter, including those mentioned, plus Amphipods.

The power plant site is located roughly between a zone that contains pollution tolerant groups (sludgeworms, fingernail clams, nematodes, midges) and the less pollution-tolerant scuds (Gammarus sp. and Hyalella sp.), and a zone that contains the pollution-sensitive scud Pontoporeia affinis, plus those other groups mentioned.

2.6.2.3 Fishes

Fishes with the highest probability of being found in Lake Erie offshore of the proposed power plant site are listed in Table 2-5. Those present in greatest numbers seasonally for spawning are so indicated. Most of the species listed spawn very close to shore (R. Kenyon, Personal Communication), or migrate up streams, in this case Elk Creek, to spawn.

The species listed in Table 2-6 were found by the Pennsylvania Fish Commission to be in the vicinity of Godfry Run, a creek located about four miles east of Elk Creek. These species are considered to be representative of the Lakeshore area, including the lake shore at Elk Creek (R. Kenyon, Pers. Commun.).

If a program of fisheries sampling were carried on for several years along this lakeshore area, the mean data obtained from offshore of Godfry Run, and that from offshore of Elk Creek would be comparable.

Fishes found upstream in Elk Creek are listed in Table 2-7. The number of species found in this region would increase if sampling were continued year-round.

The Pennsylvania Fish Commission yearly stocks coho salmon (Oncorhyncus kisutch) and chinook salmon (O. tschawytscha) in Elk Creek. These fishes are permitted to migrate to Lake Erie. The coho salmon successfully reproduce very little naturally because habitat for egg survival is generally not available in the area. Chinook salmon have so far not reproduced in the area, but are expected to spawn in October of 1973.

Some rainbow trout (Salmo gairdneri) are also stocked by the Fish Commission, but not in Elk Creek. Native populations are expected to spawn in April. The hatchery trout spawn in fall.

Species taken in sport fisheries in the area include walleye (Stizostedion vitreum), smallmouth bass (Micropterus dolomieui), salmon, and smelt (Osmerus mordax).

2.7 TERRESTIAL ECOSYSTEM

2.7.1 Birds

A listing of bird species recently seen near Erie, Pennsylvania is given in Table 2-8. This listing represents data gathered by a local ornithological group in a yearly bird count taken in winter. Such data is published annually (American Birds, 1972). The species of land birds seen in the winter count are expected to be found on the proposed site (Dr. R. Bollinger, Pers. Commun.). Sparrows would inhabit the extensive fields onsite. Wood warblers, flycatchers and woodpeckers are expected to be in the wooded and ravine areas on the site bluff.

During spring and fall migrations, hawks are numerous in the area, and can be expected to be found at the site. They do not remain long in the area, and would not attempt to nest in the site area (Dr. R. Bollinger, Pers. Commun.). During their northern migration in spring, the hawks fly along the lakeshore in large numbers, rather than continuing on a direct route across Lake Erie. Hawks expected in March include red-tails (Buteo jamaicensis) and rough-legged hawks (Buteo regalis), broadwings (Buteo platypterus), ospreys (Pandion haliatus) and marsh hawks (Circus cyaneus) are among those seen in May.

Water fowl have been seen near the lakeshore in the site vicinity. They are most numerous during spring and fall migrations. Types of waterfowl expected to be in the area include whistling swans (Cygnus columbianus), grebes, loons (Gavia spp.), canvasback (Aythya valisineria), goldeneye (Glaucionetta clangula), bufflehead (G. albeola), and mergansers. No endangered species of birds nest in the site area. Bald eagle (Haliatus leucocephalus), and peregrine falcon (Falco peregrinus), both endangered species, and osprey, a rare species, pass over the area during migration.

2.7.2 Mammals and Game Birds

Mammals found in northwestern Pennsylvania are listed in Table 2-9. Most of these could be expected at the site area (R. W. Meyer, Pers. Commun.) A concentration of western fox squirrel, exists in the site vicinity. Sizeable populations of gray squirrel (Sciurus carolinensis) and deer (Odocoileus virginianus) also exist in the area. Wild turkey (Meleagris gallopavo), which reproduce in the area, and ruffed grouse (Bonasa umbellus) may be expected onsite. The area west of the site is used for hunting.

There are no rare or endangered species of mammals in the site vicinity.

2.7.3 Vegetation

Less than one-half of the site area consists of recently cultivated fields. Areas containing shrubs and brush are adjacent to fields and dirt roads on the site. Mature deciduous forest covers the remainder of the site, including the eastern portion along Elk Creek, extends along the bluff, and covers ravine areas.

2.8 CLIMATOLOGY

The following figures indicate the climatological conditions which can be expected at the proposed plant site. The tables are based on data obtained for Port Erie Airport which is in close proximity to the site and whose climatology is characteristic of that at the site. Figure 2-1 indicates wind patterns at Port Erie Airport from 1965 to 1969. Figure 2-2 shows the frequency and mean velocity of winds recorded at Port Erie airport. Figure 2-3 is the Erie Airport wind rose from 1965 to 1969.

Climatological data for Toledo Express Airport, Cleveland Hopkins Airport and Buffalo Airport are given in Figure 2-4. These airports are located around Lake Erie. The figure gives air temperature, wind velocity and direction, precipitation and relative humidity for these locations and is characteristic of the proposed plant site data.

2.9 HISTORICAL SITES AND RECREATIONAL FACILITIES

The closest recreational facility to the proposed site is the Elk Creek Marina, located on the other bank of Elk Creek. Other nearby recreational places are the Lake City Trailer Park and Lake Erie Community Park. See Figure 2-9.

There is an authorized Federal Project for the construction of a Small Boat Harbor at the mouth of Elk Creek. The Corps of Engineers will be responsible for the entrance structure and the entrance channel. Local interests will develop the mooring facilities for public recreation. See Figure 2-10.

No actual historic site can be found within five miles of the site, except an old state line marker, which was used to separate Pennsylvania from New York. This marker is estimated to be located some 4 to 5 miles from Elk Creek.

TABLE 2-1

DOMINANT PHYTOPLANKTON ON

THE LAKE ERIE SIDE OF PRESQUE ISLE

Date	Most Abundant	Second Most	Third Most	Fourth Most	Total #/ml.
1-06-70	Cyclo-Steph	Diatoms-Pennate	Cocystis	Scenedesmus	575
1-27-70	Cyclo-Steph	Ankistrodesmus	Flagellates-Greens	Phacus	285
2-03-70	Cyclo-Steph	Dactylococcus	Greens-Coccoid	Tetrastrum	1620
2-17-70	Cyclo-Steph	Ankistrodesmus	Greens-Coccoid	Melosira	3611
5-26-70	Tetrastrum	Trachelomonas	Cyclo-Steph	Closteriopsis	146
6-09-70	Tribonema	Greens-Flagellates			22
6-23-70	Scenedesmus	Staurastrum	Tribonema	Cyclo-Steph	110
7-07-70	Tribonema	Diatoms-Pennate	Oocystis	Cyclo-Steph	672
7-21-70	Tribonema	Cyclo-Steph	Oedogonium	Staurastrum	1023
8-06-70	Oocystis	Pediastrum	Anacystis	Coelastrum	90
8-25-70	Aphanizomenon	Anacystis	Oocystis	Phacotus	569
9-01-70	Oocystis	Staurastrum	Anacystis	Anabaena	276
9-16-70	Diatoms-Pennate	Pediastrum	Sphaerocystis	Pediastrum	238
9-30-70	Diatoms-Pennate	Phacotus	Oedogonium	Pediastrum	163
12-15-70	Diatoms-Pennate	Cyclo-Steph	Melosira	Staurastrum	1568

Note: Cyclo-Steph = Cyclotella & Stephanodiscus (diatoms)

TABLE 2-2

DOMINANT PHYTOPLANKTON

AT CONNEAUT, OHIO

Date	Most Abundant	Second Most	Third Most	Fourth Most	Total #/ml.
1-07-70	Cyclo-Steph	Melosira	Ankistrodesmus	Scenedesmus	415
1-27-70	Cyclo-Steph	Ankistrodesmus			2376
2-03-70	Cyclo-Steph	Ankistrodesmus	Franceia	Scenedesmus	2530
2-17-70	Cyclo-Steph	Diatoms-Centric	Dactylococcus	Lagerheimia	2592
6-09-70	Diatoms-Pennate	Coelastrum	Cyclo-Steph	Staurastrum	66
7-07-70	Cyclo-Steph	Oocystis	Ceratium	Pediastrum	138
8-04-70	Aphanizomenon	Anabaena	Cyclo-Steph	Diatoms-Pennate	1797
9-01-70	Phacotus	Anacystis	Staurastrum	Cyclo-Steph	497
10-01-70	Diatoms-Pennate	Cyclo-Steph	Oocystis	Anacystis	249
12-16-70	Cyclo-Steph	Diatoms-Pennate	Phacotus	Dinobryon	138

TABLE 2-3

PLANKTONIC CRUSTACEANS FOR LAKE ERIE, CENTRAL BASIN, 1967

(Collected from four nearshore stations in the central basin, May through September, 1967.)

	Numbers/m^3 Maximum	Average
Cyclopoida		
Mesocyclops edax	1,600	210
Cyclops spp.	220,000	49,000
Cyclopoid stages	48,000	4,900
Calanoida		
Diaptomus spp.	6,300	790
Calanoid stages	5,400	470
Cladocera		
Bosmina sp.	40,000	11,000
Daphnia spp.	48,000	11,000
Leptodora Kindtii	25	1
Ceriodaphnia sp.	320	16
Holopedium sp.	630	32
Chydorus sphaericus	320	69

TABLE 2-4

TOTAL NUMBERS OF ZOOPLANKTON FOUND ON THE LAKEWARD SIDE OF PRESQUE ISLE (NUMBERS/ML)

(Collections taken about one mile off of Presque Isle, 25-30 feet depth)

Date	Location Relative to Lake Bottom		
	Top	Middle	Bottom
4-25-72	165	90	84
5-02-72	6,922	16,128	6,912
5-10-72	4,349	2,880	5,680
5-19-72	2,940	3,360	480
5-25-72	6,720	4,320	1,440
5-31-72	852	1,200	768
6-08-72	2,933	960	5,760
6-16-72	12,893	3,360	2,400
6-24-72	6,136	6,240	6,720
6-30-72	2,068	2,400	960
7-10-72	1,899	3,520	1,760
7-18-72	4,671	3,840	4,640
7-26-72	3,111	3,840	5,280
8-03-72	2,586	4,320	1,440
8-11-72	983	960	960
8-19-72	1,014	960	960
8-28-72	13,556	2,880	0
9-05-72	4,320	950	1,900
9-13-72	2,983	2,400	3,360
9-21-72	9,832	5,760	6,720
9-29-72	2,701	10,080	4,800
10-09-72	44,988	14,400	5,760
10-17-72	4,887	6,720	5,760
10-25-72	13,105	17,280	4,800
11-02-72	7,635	3,360	2,400
11-13-72	3,927	6,720	3,360

(From Great Lakes Research Institute 1972)

TABLE 2-5

FISHES

Distribution of Species in the Littoral Waters of Lake Erie - Elk Creek Area
(partial list)

SPECIES		JUVENILE	ADULT
Walleye	*Stizostedion vitreum*	M	M
Yellow perch	*Perca flavescens*	A	A
Logperch darter	*Percina caprodes*	M	R
Johnny darter	*Etheostoma nigrum*	M	M
Spottail shiner	*Notropis hudsonius*	A	A
Emerald shiner	*Notropis atherinoides*	A	A
Silver chub	*Hybopsis storeriana*	R	R
Carp	*Cyprinus carpio*	A	A
Goldfish	*Carassius auratus*	A	A
Bluntnose minnow	*Pimephales notatus*	R	M
Trout-perch	*Percopsis omiscomaycus*	A	A
Freshwater drum	*Aplodinotus grunniens*	R	A
Smelt	*Osmerus mordax*	A	A
Rainbow trout	*Salmo gairdneri*	S,M	S,M
Brown trout	*Salmo trutta*	R	R
Lake trout	*Salvelinus namaycush*	R	R
Brook trout	*Salvelinus fontinalis*	R	R
Coho salmon	*Oncorhynchus kisutch*	S,A	S,A
Chinook salmon	*Oncorhynchus tschawytscha*	S,A	S,A
Lake sturgeon	*Acipenser fulvescens*	R	R
Lake whitefish	*Coregonus clupeaformis*	R	R
Alewife	*Alosa psuedoharengus*	M	M
Gizzard shad	*Dorosoma cepedianum*	A	M
Smallmouth bass	*Micropterus dolomieui*	M	M
Largemouth bass	*Micropterus salmoides*	M	M
Rock bass	*Ambloplites rupestris*	M	M
Common sunfish	*Lepomis gibbosus*	M	M
Bluegill	*Lepomis macrochirus*	M	M
White crappie	*Pomoxis annualaris*	R,M	R,M
Common sucker	*Catostomus commersoni*	A	A
Eastern quillback carpsucker	*Carpiodes cyprinus*	M	M
Shorthead redhorse sucker or	*Moxostoma macrolepidotum* or *Moxostoma aureolum*	M	M
Northern pike	*Esox lucius*	R	R
Channel catfish	*Ictalurus punctatus*	M	M
Brown bullhead	*Ictalurus nebulosus*	M	M
Stonecat madtom	*Norurus flavus*	A	A
Brook silversides	*Labidesthes sicculus*	R	R
American eel	*Anguilla rostrata*	R	R
Sea Lamprey	*Petromyzon marinus*	R	R
Longnose gar	*Lepisosteus osseus*	R,M	R,M

KEY: A - Abundant or common M - Modestly abundant

R - Rare S - Seasonally abundant

TABLE 2-6

FISHES OF LAKE ERIE FOUND NEAR
GODFRY RUN, ERIE COUNTY, PENNSYLVANIA

COMMON NAME	SCIENTIFIC NAME	MIGRATE FOR SPAWNING	SHALLOW WATER AS ADULTS	DEEP WATER AS ADULTS	EXPECTED SPAWNING DATES FOR LAKE ERIE	EXPECTED SPAWNING TEMPERATURE RANGES*	EXPECTED DEPTH OF LAKE WHERE SPAWNING OCCURS (FEET)
Walleye	Stizostedion vitreum	Streams & Shallows	To 30 feet		May	40-50°F	3-24
Yellow perch	Perca flavescens		To 60 feet	X	Mid Apr-May	44-54°F	3-36
Logperch darter	Percina caprodes		To 30 feet		May-June	55°F	1-20
Johnny darter	Etheostoma nigrum		X		May-June	55°F	1-20
Spottail shiner	Nortopis hudsonius		3-60 feet		June-July	65-70°F	1-36
Emerald shiner	Nortopis atherinoides			X	June 25 mid-August		
Carp	Cyprinus carpio		X X		June	15-20°C	To 36
Goldfish	Carassius auratus		X		June-July	18-30°C	To 36
Bluntnose minnow	Pimephales notatus	Streams & Shallows	X		May-Aug.	60-70°F	To 8
Trout-perch	Percopsis omiscomaycus	Streams & Shallows		X	June 1-15	19-22°C	Shallow
Freshwater drum	Aplodinotus grunniens		5-100 feet		May-June	22°C	To 36
Smelt	Osmerus mordax	Streams & Shallows		X	May-June	36-50°F	To 12
Rainbow Trout	Salmo gairdneri	Streams	X		April	36-50°F	
Coho Salmon	Oncorhyncus kisutch	Streams		X	November	40-55°F	

TABLE 2-6 (CONTINUED)

COMMON NAME	SCIENTIFIC NAME	MIGRATE FOR SPAWNING	SHALLOW WATER AS ADULTS	DEEP WATER AS ADULTS	EXPECTED SPAWNING DATES FOR LAKE ERIE	EXPECTED SPAWNING TEMPERATURE RANGES*	EXPECTED DEPTH OF LAKE WHERE SPAWNING OCCURS (FEET)
Chinook salmon	O. tschawytscha	Streams		X	Oct-1973	40-55°F	
Alewife	Alosa pseudoharengus	Shallows		X	May-July	55°F	15-20
Smallmouth bass	Micropterus dolomieui		To 40 feet		Spring	60-64°F	2-12
Largemouth bass	M. salmoides		X		May-June	64°F	0.5-6
Rock bass	Ambloplites rupestris		To 40 feet		Spring	64°F	To 8
Common sunfish	Lepomis gibbosus		To 40 feet		Late spring-early summer	64-70°F	To 12
Bluegill	L. macrochirus		To 40 feet		Spring	64-70°F	To 12
Common sucker	Catostomus commersoni	Streams & Shallows	X	X	Spring	65°F	
Eastern quillback carpsucker	Carpoides cyprinus	Streams	X		Spring	39°F	
Shorthead redhorse sucker	Moxostoma macrolepidotum or M. aureolum	Streams					
Channel catfish	Ictalurus punctatus	Streams & Shallows	To 30 feet		June	65°F	
Brown bullhead	I. nebulosus		To 40 feet		Late Spring	21-25°C	12
Stonecat madtom	Noturus flavus		X		June-Aug		
Gizzard Shad	Dorosoma cepedianum		X		June-early	20°C	Shallow

*Approximate
(From Hubbs, 1949; Breder, 1966; Carlander, 1970; and R. Kenyon, Persoanl Communication)

TABLE 2-7

FISH SPECIES PRESENT IN ELK CREEK, ERIE COUNTY, PENNSYLVANIA ON NOVEMBER 6, 1971

(From Dr. E. C. Masteller, Personal Communication)*

Common Name	Scientific Name
White sucker	*Catostomus commersoni*
Hognose sucker	*Hypentelium nigricans*
River chub	*Hybopsis micropogon*
Big-eye chub	*H. amblops*
Tongue-tied chub	*Parexoglossum laurae*
Creek chub	*Semotilus atromaculatus*
Common shiner	*Notropis cornutus*
Sand shiner	*N. deliciosus*
Silver jaw minnow	*Ericymba buccata*
Blacknose dace	*Rhinichthys atratulus*
Longnose dace	*R. cataractae*
Redside dace	*Clinostomus elongatus*
Stoneroller	*Campostoma anomalum*
Johnny darter	*Etheostoma nigrum*
Rainbow darter	*E. caeruleum*
Fantail darter	*E. flabellare*
Greenbanded darter	*E. blennoides*
Variegated darter	*E. variatum*

*Specimens taken at town of McKean by electroshocking.

TABLE 2-8

BIRDS OF ERIE, PENNSYLVANIA, ON DECEMBER 18, 1971

Count taken within 7.5 mile radius of southeast Erie, including Presque Isle State Park. (From American Birds, 1972)*

Common Name	Scientific Name	Number Observed
Horned grebe	Colymbus auritus	8
Pied-billed grebe	Podilymbus podiceps	8
Double-creasted cormorant	Phalacrocorax auritus	2
Great blue heron	Ardea herodias	2
Whistling swan	Cygnus columbianus	58
Canada goose	Branta canadensis	67
White-fronted goose	Anser albifrons	1
Mallard	Anas platyrhynchos	502
Black duck	Anas rubripes	168
Gadwall	Anas strepera	10
Pintail	Anas acuta	11
Green-winged teal	Anas carolinensis	2
Wood duck	Aix sponsa	3
Redhead	Aythya americana	13
Ring-necked duck	Aythya collaris	2
Canvasback	Aythya valisineria	514
Greater scaup	Aythya marila	233
Lesser scaup	Aythya affinis	10
Common goldeneye	Glaucionetta clangula	111
Bufflehead	Glaucionetta albeola	121
Oldsquaw	Clangula hyemalis	1
Ruddy duck	Erismatura jamaicensis	2
Hooded merganser	Lophodytes cucullatus	1
Common merganser	Mergus merganser	2
Red-breasted merganser	Mergus serrator	11
Goshawk	Accipiter gentilis	1
Red-tailed hawk	Buteo jamaicensis	2
Kestrel	Falco sparverius	9
Ring-necked pheasant	Phasianus colchicus	1
American coot	Fulica americana	932
Common snipe	Capella gallinago	8
Great black-backed gull	Larus marinus	24
Herring gull	Larus argentatus	1,631
Ring-billed gull	Larus delawarensis	5,227
Bonaparte's gull	Larus philadelphia	451
Mourning dove	Zenaidura macroura	17
Great horned owl	Bubo virginianus	1
Belted kingfisher	Megaceryle alcyon	2
Yellow-shafted flicker	Colaptes auratus	15

TABLE 2-8 (Continued)

Common Name	Scientific Name	Number Observed
Pileated woodpecker	Hylatomus pileatus	1
Red-headed woodpecker	Melanerpes erythrocephalus	1
Hairy woodpecker	Dendrocopus villosus	6
Downy woodpecker	Dendrocopus pubescens	32
Horned lark	Eremophila alpestris	25
Blue jay	Cyanocitta cristata	30
Common crow	Corvus brachyrhynchos	14
Black-capped chickadee	Parus atricapillus	171
Tufted titmouse	Parus bicolor	8
White-breasted nuthatch	Sitta carolinensis	19
Red-breasted nuthatch	Sitta canadensis	4
Brown creeper	Certhia familiaris	5
Winter wren	Troglodytes troglodytes	2
Mockingbird	Minus polyglottos	1
Golden-crowned kinglet	Regulus satrapa	11
Cedar waxwing	Bombycilla decrorum	107
Northern shrike	Lanius excubitor	1
Starling	Sturnus vulgaris	76
Myrtle warbler	Dendroica coronata	35
House sparrow	Passer domesticus	275
Red-winged blackbird	Agelaius phoeniceus	29
Bronze-headed cowbird	Molothrus ater	2
Cardinal	Richmondena cardinalis	79
Evening grosbeak	Hesperiphona vespertina	13
American goldfinch	Spinus tristis	35
Rufous-sided towhee	Pipilo erythrophthalmus	4
Slate-colored junco	Junco hyemalis	56
Tree sparrow	Spizella arborea	218
White-throated sparrow	Zonotrichia albicollis	6
Song sparrow	Melospiza melodia	15
Snow bunting	Plectrophenax nivalis	32

Total number os species = 70

*Weather conditions during count: cloudy, temperature 20° to 24°, wind NW, 10-20 mph, 4-6 inches snow cover.

TABLE 2-9

MAMMALS OF NORTHWESTERN PENNSYLVANIA

(From Doutt, et. al., 1967)

Common Name	Scientific Name
Opossum	Dedelphis marsupialis
Smoky shrew	Sorex fumeus
Short-tailed shrew	Blarina brevicauda
Pygmy shrew	Microsorex hoyi
Least shrew	Cryptotis parva
Hairy-tailed mole	Paras calops breweri
Star-nosed mole	Condylura cristata
Little brown bat	Myotis lucifugus
Keen bat	Myotis keenii
Indiana bat	Myotis sodalis
Leib bat	Myotis subulatus
Silver-haired bat	Lasionycteris noctivagans
Pygmy bat	Pipistrellus subflavus
Big brown bat	Eptesicus fuscus
Red bat	Lasiurus borealis
Hoary bat	Lasiurus cinereus
Eastern cottontail	Sylvilagus floridanus
Chipmunk	Tamias striatus
Woodchuck	Marmota monax
Gray squirrel	Sciurus carolinensis
Fox squirrel	Sciurus niger
Red squirrel	Tamiasciurus hudsonicus
Eastern flying squirrel	Glaucomys volans
Deer mouse	Peromyscus maniculatus
White-footed mouse	Peromyscus leucopus
Gapper's red-backed vole	Clethrionomys gapperi
Meadow vole	Victrotus pennsylvanicus
Pine vole	Pitymys pinetorum
Muskrat	Ondatra zibethicus
Southern bog lemming	Synaptomys cooperi
Norway rat	Rattus norvegicus
Meadow jumping mouse	Zapus hudsonius
Woodland jumping mouse	Napaeozapus insignis
Red fox	Vulpes fulva
Gray fox	Urocyon cinereoargenteus
Raccoon	Procyon lotor
Least weasel	Mustela rixosa
Long-tailed weasel	Mustela frenata
Skunk	Mephitis mephitis
White-tailed deer	Odocoileus virginianus

TABLE 2-10

PROVISIONAL MAXIMUM TEMPERATURES
RECOMMENDED AS COMPATIBLE WITH THE WELL-BEING OF VARIOUS
SPECIES OF FISH AND THEIR ASSOCIATED BIOTA

93°F	Growth of catfish, gar, white or yellow bass, spotted bass, buffalo, carpsucker, threadfin shad, and gizzard shad.
90°F	Growth of largemouth bass, drum, bluegill, and crappie.
84°F	Growth of pike, perch, walleye, smallmouth bass, and sauger.
80°F	Spawning and egg development of catfish, buffalo, threadfin shad, and gizzard shad.
75°F	Spawning and egg development of largemouth bass, white, yellow, and spotted bass.
68°F	Growth or migration routes of salmonids and for egg development of perch and smallmouth bass.
55°F	Spawning and egg development of salmon and trout (other than lake trout).
48°F	Spawning and egg development of lake trout, walleye, northern pike, sauger, and Atlantic salmon.

NOTE: Recommended temperatures for other species, not listed above, may be established if and when necessary information becomes available.

GILBERT ASSOCIATES, INC.

TABLE 2-11

SOIL CLASSIFICATION SHEET

SHEET 1 OF 3

PROJECT: GPU W.O. 4525-00 SITE AREA Lake City DRILL HOLE NO. T-6

CONTRACTOR: S&H COORDINATES Baseline Sta. 1+00 Left 195 ELEVATION 699.3

DRILLER: Homer Growden GWL 0 HRS 10.8

CLASSIFIED BY: R.E.L. DATE: 4-10-72 24 HRS 17.6

Depth Ft.	Sample No.	SPT Blows/6 In. 6	12	18	Rec.-Ft	Profile	SOIL DESCRIPTION Density (or Consistency), Color Soil Type - Accessories	U.S.C.S.	w%	Coarse Granular Soils: Range Size / Core Run	Grain Shape / Rec. Core	REMARKS Chemical Comp, Geologic Data, Ground Water, Construction Problems, etc.
0	1	1	1	3			Med.brn.silty sand,f.-med.grained tr.organic debris,damp	SM				
	2	3	6	9		3.0	Lt.yellow brn.silty f.sand,damp, loose	SP				
	3	8	4	5			Med.brn.sand,well graded,damp, loose,tr.gravel					
5	4	4	3	4			Same as above					
	5	2	3	6			Same as above					
	6	5	5	4			Same as above					
10	7	9	7	6		10.5	Med.brn.gravelly sand,well graded loose,damp,est 10-20% gravel	SW				
	8	4	4	3			Med.brn.sand,f.-med.grained,damp loose	SP				
	9	4	4	5			Same as above - tr.silt					
15	10	4	5	6			Same as above					
	11	64	16	10			Same as above					Note change in blow count - casing set at 15' and hole cleaned out before sample #11 was taken
	12	13	12	11			Med.brn.sand,f.-med.grained,moist, loose,tr.gravel,tr.silt					
	13	9	7	6			Same as above - moist to wet					
20	14	4	4	5		21.0	Same as above - moist to wet					
	15	13	16	17			Med.brn.sandy silt w/tr.gravel, moist to wet,stiff					
	16	4	7	9			Same as above	ML				
25	17	19	23	26		25.5	Same as above - FeO_2 staining					
	18	12	17	21		27.0	Gray silty v.fine sand,moist, poorly graded	SM				
	19	36	38	40			Gray,v.fine sandy silt,not plastic, damp to moist,stiff					
30	20	21	34	39			Same as above	ML				
	21	9	13	16			Same as above - moist to wet					
	22	24	22	23			Same as above					
	23	18	34	28			Same as above					
35	24	46	38	44		36.0	Same as above					
	25	2	6	9		37.0	Gray silty v.fine sand,loose,wet	SM				
	26	31	34	37			Gray v.fine sandy silt,not plastic, damp to moist,v.stiff					
40	27	23	30	45			Same as above - tr. c. sand	ML				
	28	21	30	39			Same as above - moist to wet					
	29	3	6	14		43.5	Gray v. fine sandy silt,not plastic, moist to wet, stiff					
45	30	14	27	31			Gray v.fine sandy silt to silty f sand, moist to wet,v.stiff	SM				
	31	16	23	27			Same as above	ML				
	32	32	36	43		48.0	Same as above - damp					
50	33	4	5	17			Gray v. fine sandy silt, not plastic moist, stiff					

GILBERT ASSOCIATES, INC.

TABLE 2-11

SOIL CLASSIFICATION SHEET

SHEET 2 OF 3

PROJECT: GPU W.O. 4525-00 SITE AREA Lake City DRILL HOLE NO. T-6

CONTRACTOR: S&H COORDINATES Baseline Sta. 1+00 ELEVATION 699.3

DRILLER: Homer Growden Left 195 GWL 0 HRS 18.2 / 4-12

CLASSIFIED BY: R.E.L. DATE: 4-11-72 24 HRS

Depth Ft.	Sample No.	SPT Blows/6 In. 6	12	18	Rec. Ft	Profile	SOIL DESCRIPTION Density (or Consistency), Color Soil Type - Accessories	U.S.C.S.	% REC.	Coarse Granular Soils: Range Size / Core Run	Grain Shape / Rec. Core	REMARKS Chemical Comp, Geologic Data, Ground Water, Construction Problems, etc.
50												
	34	19	31	44			Same as previous description - damp					
	35	21	36	43			Same as above - damp					
	36	29	37	39			Same as above - moist to wet					
55	37	5	9	17			Gray v.f.sandy silt-silty f.sand, si.plas., low-mod.dry strength, wet, stiff	ML To SM				
	38	10	19	28			Same as above					
	39	24	29	37			Same as above - damp to moist					
60	40	22	27	42			Same as above					
	41	18	21	34			Gray silty v.f.sand-sandy silt, not plas., rapid dil., damp, med.-stiff	SM To ML				
	42	26	31	52			Same as above					
	43	25	37	49			Same as above					
65	44	27	32	51			Same as above					
	45	20	27	33			Same as above					
	46	22	31	46			Same as above					
70	47	31	39	44			Same as above					
	48	37	43	51			Same as above					
	49	19	27	36			Same as above					
75	50	25	41	59			Same as above					
	51	27	41	52			Gray silty v.f.sand-v.f.sandy silt, damp-moist, stiff-v.stiff					
	52	19	29	46			Same as above					
	53	10	23	38			Same as above					
80	54	13	34	46			Same as above					
	55	23	36	41			Same as above					
	56	29	47	56		84.4	Same as above					
85	57	16	28	29			Gray silt, slight-mod.plastic, mod. dry strength, slow dil., damp	ML				
	58	21	33	48								
	59	28	42	63								
90	60	33	52	69								
	61	63	76	118			Gray clayey sandy silt, slight-mod. plas., mod.dry strength, est.35% sand, est 10% clay (?), hard			91.5		
							Same as above - w/est 15% gravel	ML	33	1.5	0.5	
	62	56	216	296			Gray clayey sandy silt, dry-damp, hard, est 35% sand, est 10% clay (?)					
95	63	58	92	100/04			Same as above			95.9		
							Same as above w/a few lenses (< 1") of f. sand		73	1.1	0.8	
									100	2.0	2.0	
										99.0		
100									100	2.0	2.0	

GILBERT ASSOCIATES, INC.

TABLE 2-12

SOIL CLASSIFICATION SHEET

SHEET 1 OF 3

PROJECT: GPU   W.O. 4525-00   SITE AREA: Lake City   DRILL HOLE NO. CT 2A

CONTRACTOR: S&H   COORDINATES: Baseline Sta. 11+60 365' Right   ELEVATION 670.5

DRILLER: Paul Parks   GWL 0 HRS 7.3 - 3-31

CLASSIFIED BY: R.E.L.   DATE: 3-30-72   24 HRS 8.8 - 4-[illegible]

Depth Ft.	Sample No.	SPT Blows / 6 In. 6	12	18	Rec. Ft.	Profile	SOIL DESCRIPTION Density (or Consistency), Color Soil Type - Accessories	U.S.C.S.	% Rec	Coarse Granular Soils: Range Size / Core Run	Grain Shape / Rec. Core	REMARKS Chemical Comp., Geologic Data, Ground Water, Construction Problems, etc.
0	1	1	1	4		1.5	Lt.brn.f.to med.grained sand, 10% fines,damp,tr.gravel	SP				
	2	4	4	6			Mottled & iron stained f.to med. silty sand w/lenses of silt,moist, to wet,tr.med.-crse.sand,mottled f.to med.silty sand w/lense of gravel,wet					
	3	7	7	7								
5	4	5	7	10			Mottled & iron stained silty sand-sandy silt,sand f.grained w/some med.-crse.grained	SM ML				
	5	5	7	9			Same as above					
	6	5	8	10			Same as above					
10	7	7	5	4		10.0	Same as above					
	8	3	3	4			gray,v.fine sandy silt,tr.gravel, no plasticity,rapid dilatancy,low dry strength,wet					
	9	4	5	6			Same as above					
15	10	6	10	14			Same as above w/est. 15% med. grained sand					
	11	8	11	14			Same as above	ML				
	12	5	9	8			Gray,v.fine sandy silt,tr.gravel, no plasticity,rapid dilatancy,low dry strength,wet					
	13	6	11	13			Same as above					
20	14	7	11	14			Same as above					
	15	9	10	14		22.5	Same as above					
	16	10	19	24			Gray silty v.fine sand,tr.gravel just over 50% v.fine sand,wet	SM				
25	17	10	14	15		25.5	Same as above					
	18	8	9	13			Gray,v.fine sandy silt,tr.gravel, no plasticity,rapid dilatancy, low dry strength,wet					
	19	10	15	19			Same as above	ML				
30	20	12	16	19			Same as above					
	21	10	15	14			Same as above w/iron rich sand content					
	22	8	12	16			Gray v.fine sandy silt,no plasticity, rapid dilatancy,low dry strength,wet					
	23	9	12	18			Same as above					
35	24	3	6	7			Gray v.f.sandy silt,less sand than above, mod.rapid dilatancy,no plasticity,moist to wet,soft to med.,low dry strength					
	25	5	11	11			Same as above - moist medium					
	26	5	5	7			Same as above - medium					
40	27	6	7	8			Same as above - soft to medium					
	28	7	12	17			Gray v.fine sandy silt,no plasticity, rapid dilatancy,low dry strength, stiff,damp to moist					
	29	22	35	47			Gray sandy silt,sand f-med.grained, no plasticity,rapid dilatancy, low dry strength,med.consistency,moist to wet,tr.f.gravel	ML				
45	30	13	20	31								
	31	24	56	95			Gray f.sandy silt w/thin layers of med. to coarse grained sand w/tr. gravel,moist to wet					
	32	[illegible]	21	32			Same as above					
	33	3[illegible]	38	28			Grayv.f.sandy silt,no plasticity,rapid dilatancy,low dry strength,moist, med. consistency					
50												

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GILBERT ASSOCIATES, INC.

TABLE 2-11

SOIL CLASSIFICATION SHEET

SHEET 3 OF 3

PROJECT: GPU W.O. 4525-00 SITE AREA Lake City

DRILL HOLE NO. T-6

CONTRACTOR: S&H COORDINATES Baseline Sta. 1+00 Left 195

ELEVATION 699.3

DRILLER: Homer Growden

GWL 0 HRS 22.1 / 4-15

CLASSIFIED BY: R.E.L. DATE: 4-13-72

24 HRS

Depth Ft.	Sample No.	SPT Blows/6 In. 6	12	18	In. Rec.	Profile	SOIL DESCRIPTION Density (or Consistency), Color Soil Type - Accessories	U. S. C. S.	% Rec.	Coarse Granular Soils: Range Size / Core Run	Grain Shape / Rec. Core	REMARKS Chemical Comp, Geologic Data, Ground Water, Construction Problems, etc.
100										101.0		
	64	28	32	36			Gray clayey sandy silt, sl.-mod. plas., mod. dry strength, slow dil. dry, hard, est 35% sand, est 10% clay	ML	(?)			
	65	29	40	54			Same as above					
105	66	53	100/[illegible]	R			Same as above - tr. gravel			105.25		
						106.0			0	0.75	NR	
							Gray silty sand w/tr. clay & est 10-15% gravel, v. dense, sand is v. f. grained to crs. grained, gravel up to 2"		67	1.5	1.0	glacial till (?)
									95	2.0	1.9	
110	67	112	R	R						110.0		
							Same as above - w/siltstone cobble		23	3.0	0.7	
							Gray silty sand-sandy silt, tr. clay, tr. gravel, sand is f. grained, damp		40	2.0	0.8	
115												
	68	41	76	100/2						116.2		
							Gray silty sand, tr. gravel, damp		5	1.8	0.1	
	69	125	R	R						118.5		580.8 EL
120									100	1.5	1.5	
							Gray claystone-siltstone, core pieces 4" to 1", thin bedded & cross bedded on a small scale		100	5.0	5.0	
125										125.0		
							Terminated at 125.0'					

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GILBERT ASSOCIATES, INC.

SOIL CLASSIFICATION SHEET

TABLE 2-12

SHEET 2 OF 3

PROJECT: GPU W.O. 4525-00 SITE AREA Lake City DRILL HOLE NO. CT 2A

CONTRACTOR: S&H COORDINATES Baseline Sta. 11+60 365' Right ELEVATION 670.5

DRILLER: Paul Parks GWL 0 HRS 9.0 / 4-5

CLASSIFIED BY: R.E.L. DATE: 4-3-72 24 HRS

Depth Ft.	Sample No.	SPT Blows/6 In. 6	12	18	Rec. Ft.	Profile	SOIL DESCRIPTION Density (or Consistency), Color Soil Type - Accessories	U. S. C. S.	% Rec	Coarse Granular Soils: Range Size / Core Run	Grain Shape / Rec. Core	REMARKS Chemical Comp., Geologic Data, Ground Water, Construction Problems, etc.
50												
	34	42	41	46			Same as previous description					
	35	25	33	45			Same as above					
	36	38	74	76			Gray v.f.sandy silt,no plasticity,rapid dilatancy,low dry strength,med. consistency,moist	ML				
55	37	35	47	78			Same as above - tr.med.grained sand					
	38	4	16	14		57.0	Gray v.f.sandy silt w/some clay,slow dilatancy,slight-mod.plasticity, damp to moist					
	39	23	23	33			Gray silty sand,well graded sand, est.25-30% slt.plas.fines,v,stiff to hard,damp	SM				
60	40	12	26	37			Gray silty sand-sandy silt,stiff-v.stiff,damp-moist	SM to ML				
	41	12	23	71		61.5	Gray silty sand,well graded sand, est.25-30%none-sli.plas.fines,v. stiff-hard,damp-moist,tr.gravel	SM				
	42	15	19	30			Gray sandy silt,none-slight plas. mod.dilatancy,low dry strength, damp to moist,stiff	ML				
	43	18	23	32			Same as above					
65	44	39	73	133		66.0	Gray f.sandy silt w/vert.seam of crse.-med.sand w/tr.gravel on edge of sample,damp,hard	ML				
	45	39	86	175			Gray silty f.sand-v.f.sandy silt, sand well grained,hard,damp	ML				
	46	23	42	93		69.0	Same as above	SM				
70	47	19	18	32			Gray f.sandy silt,slightly plas., mod.-slow dilatancy,low-mod.dry strength,v.stiff-hard,damp	ML				
	48	20	48	82			Same as above - tr. gravel					
	49	21	39	77			Same as above - tr. gravel					Apparent vert. seam of sand w/tr. gravel
75	50	14	20	27			Same as above - tr. gravel					
	51	28	36	42			Gray silt,est.15%sand,wet,rapid dil., low dry strength,sl.plas.,med.consistency					
	52	62	45	114			Gray gravelly sandy silt,stiff,moist, tr.clay,slow dil.,sl.-mod. plas., est.10%gravel 15% sand					
	53	57	66	87			Similar to above-tr.gravel,v.stiff					
80	54	35	62	250			Gray sandy silt,low dry strength, sl.plas.,slow-rapid dil.,damp-moist, v. stiff-hard	ML				
	55	25	150/.64	R			Gray silt,est.10% sand,none-sl.plas., low dry strength,rapid dil.,moist-wet,stiff					
	56	16	33	100			Gray silt,est.10%sand,tr.gravel,sl.-mod.plas.,rapid-slow dil.,damp,v.stiff-hard,low dry strength					
85	57	17	30	49		86.0	Same as above - sl.plas.mod.dry strength					
	58	24	41	79		87.0	Gray gravelly silty sand,est.15% gravel,moist to wet	SM				Appears as if spoon is splitting near vert. contact between silt and gravelly sand w/silt
	59	7	27	56		88.5	Gray silt,tr.sand,none-sl.plas.mod. dil.,stiff-v.stiff,damp,low dry strength	ML				
90	60	92	100/.63	R		90.0	Gray silty gravelly sand,est.10% gravel,wet,no plastic fines	SM				
	61	11	33	74			Gray sandy silt,tr.gravel,mod.dil., low plas.,low dry strength,damp to moist,stiff to v.stiff	ML				
	62	20	23	36			Same as above					
	63	36	70	68			Gray silt,tr.sand,vert.clay layers, sl.-mod.plas.,low-mod.dry strength, v.stiff,moist					
95	64	33	67	73			Same as above			96.0		El. 574.5
							Gray siltstone-claystone,minor cross bedding,horizontal orientation, core pieces less than 4"		80	1.0	0.8	
100									79	4.5	3.55	Nx core

GILBERT ASSOCIATES, INC. TABLE 2-12

SOIL CLASSIFICATION SHEET

SHEET 3 OF 3

PROJECT: GPU W.O. 4525-00 SITE AREA Lake City DRILL HOLE NO. CT 2A

CONTRACTOR: S&H COORDINATES Baseline Sta. 11+60 ELEVATION 670.5

DRILLER: Paul Parks 365' Right GWL 0 HRS

CLASSIFIED BY: R.E.L. DATE: 4-7-72 24 HRS

Depth Ft.	Sample No.	SPT Blows/6 In. (6 12 18)	Rec.-Ft	Profile	SOIL DESCRIPTION Density (or Consistency), Color Soil Type - Accessories	U.S.C.S.	% Rec	Coarse Granular Soils: Range Size / Core Run	Grain Shape / Rec. Core	REMARKS Chemical Comp, Geologic Data, Ground Water, Construction Problems, etc.
100					Gray siltstone-claystone (see previous description)		100	101.5 3.0 104.5	3.0	
105					Terminated boring at 104.5'					
110										

TABLE 2-15

Analyses of Samples taken from Lake Erie West of the mouth of Elk Creek

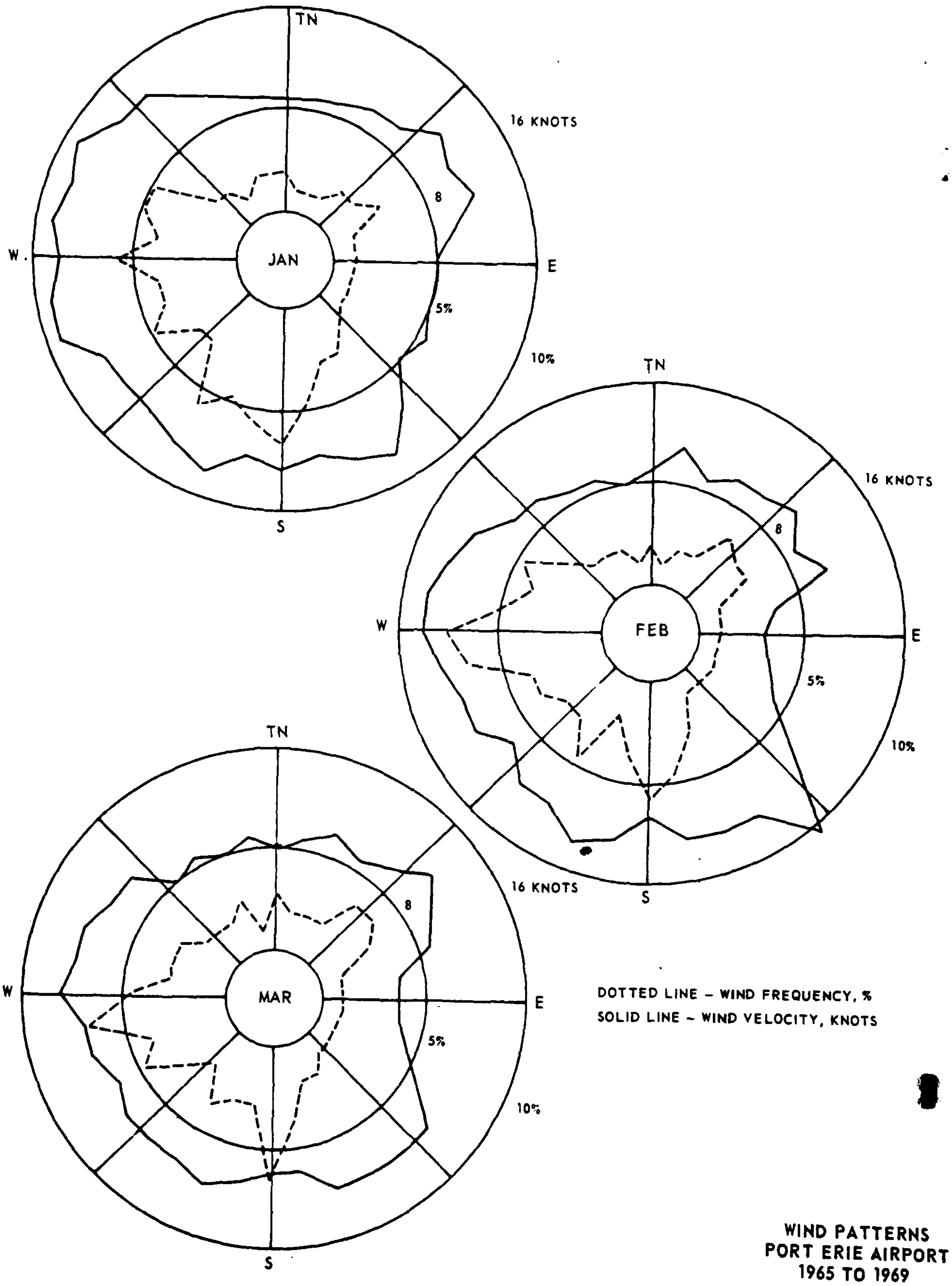
LAKE CITY STATION

Laboratory Number		260584	262306	262305	262307	262550	262552	262551						
Distance Off Shore		150 ft	1500ft	1000ft	200ft	1000ft	2000ft	1500ft						
Sampling Date		2-11-72	5-1-72	5-1-72	5-1-72	5-12-72	5-12-72	5-12-72						
Calcium	Ca	31.2	34.4	32.8	32.8	30.4	32.0	32.0						
Magnesium	Mg	8.8	7.8	7.8	7.8	7.3	7.3	7.3						
Sodium	Na	22.9	15.3	17.1	16.2	18.3	18.1	16.8						
Bicarbonates	HCO_3	79.3	92.7	95.1	91.5	87.8	85.4	87.8						
Sulfates	SO_4	41.8	23.4	22.3	18.3	23.7	25.7	25.7						
Chlorides	Cl	35.0	26.0	25.0	23.0	24.0	24.0	24.0						
Nitrates	NO_3	7.0	5.3	5.8	5.6	6.6	8.3	7.4						
Conductivity	Mmho	338	315	311	305	282	290	288						
Hydrogen Ion Conc.	pH	7.8	7.8	7.6	8.1	8.0	8.0	8.0						
Free Carbon Dioxide	CO_2	1.0												
Total Hardness	$CaCO_3$	114	118	114	114	106	110	110						
Silica - soluble	SiO_2	3.5	0.72	0.54	0.28	0.56	0.46	0.72						
Silica - colloidal	SiO_2													
Iron - soluble	Fe	0.08	0.02	0.03	0.03	0.03	0.03	0.03						
Iron - total	Fe	0.40	0.27	0.25	0.13	0.91	0.67	0.72						
Iron & Alum. Oxides	R_2O_3	0.1	0.3	0.3	0.03	0.2	0.2	0.2						
Manganese	Mn	0.11	0.06	0.05	0.05	0.06	0.06	0.07						
Chlorine Demand	Cl_2													
Chemical Oxygen Demand														
Color		10	5	5	5	5	5	5						
Turbidity		5	5	5	5	25	20	20						
Suspended Solids		11	7.2	6.0	2.2	35	32	26						
Soluble Solids		189	164.8	164.4	160.7	160	165	162						
Total Solids		201	172	170.4	162.9	195	197	188						
Calcium	$CaCO_3$	78.0	86	82	82	76.0	80.0	80.0						
Magnesium	$CaCO_3$	36.0	32	32	32.0	30.0	30.0	30.0						
Sodium	$CaCO_3$	49.6	33.3	37.2	35.2	39.7	39.2	36.5						
Total Cations	~~$CaCO_3$~~	163.6	151.3	151.2	149.2	145.7	149.2	146.5						
	$CaCO_3$													
Bicarbonates	$CaCO_3$	65.0	76.0	78	75.0	72.0	70.0	72.0						
Sulfates	$CaCO_3$	43.5	24.3	32.2	19.0	24.6	26.7	26.7						
Chlorides	$CaCO_3$	49.4	36.7	35.3	36.7	33.8	33.8	33.8						
Nitrates	$CaCO_3$	5.7	4.3	4.7	4.5	5.3	6.7	6.0						
Total Anions	$CaCO_3$	163.6	151.3	151.2	149.2	145.7	149.2	146.5						

GILBERT ASSOCIATES, INC.

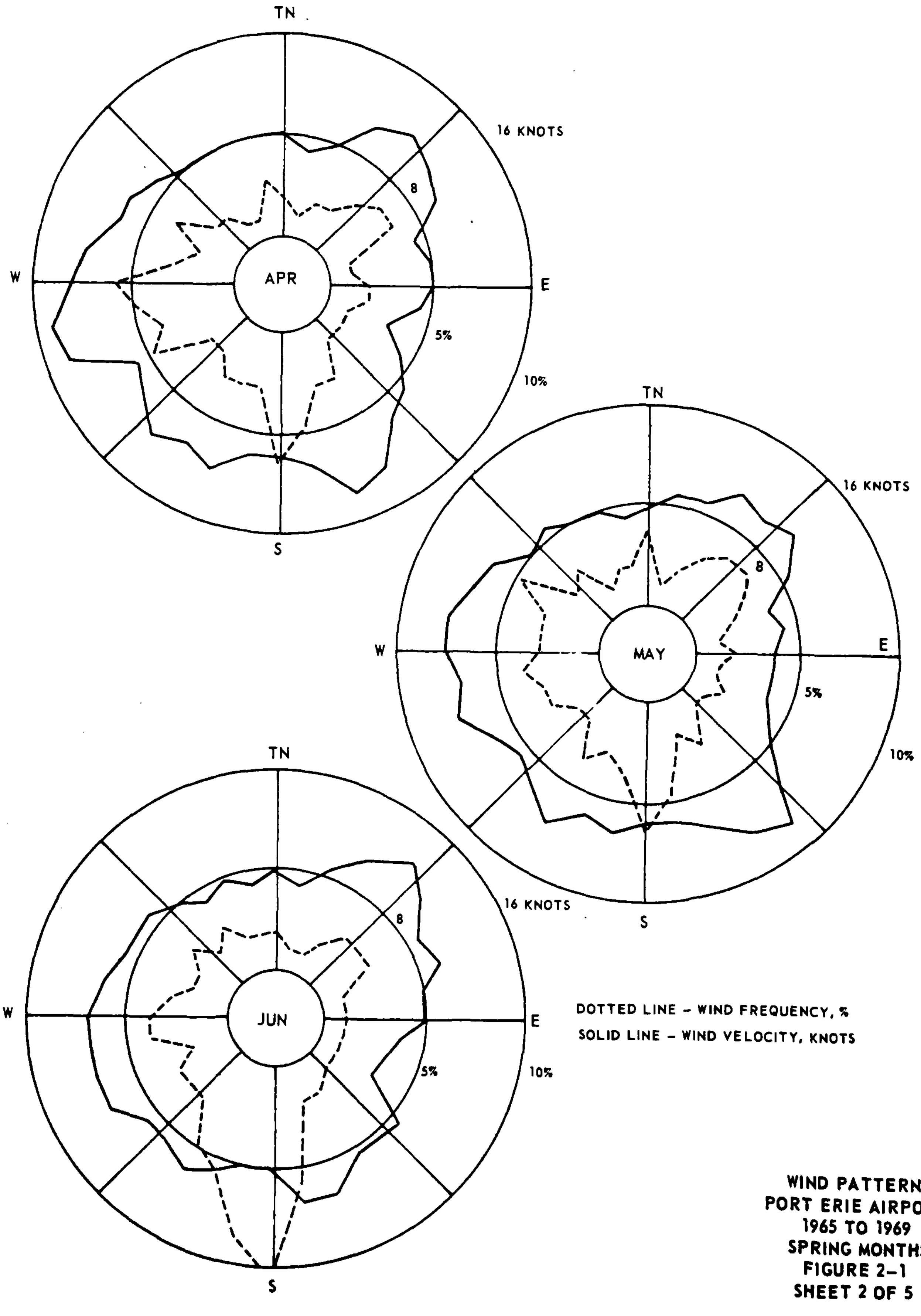
All results expressed in parts per million except pH, conductivity, color & turbidity

PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



WIND PATTERNS
PORT ERIE AIRPORT
1965 TO 1969
WINTER MONTHS
FIGURE 2-1
SHEET 1 OF 5

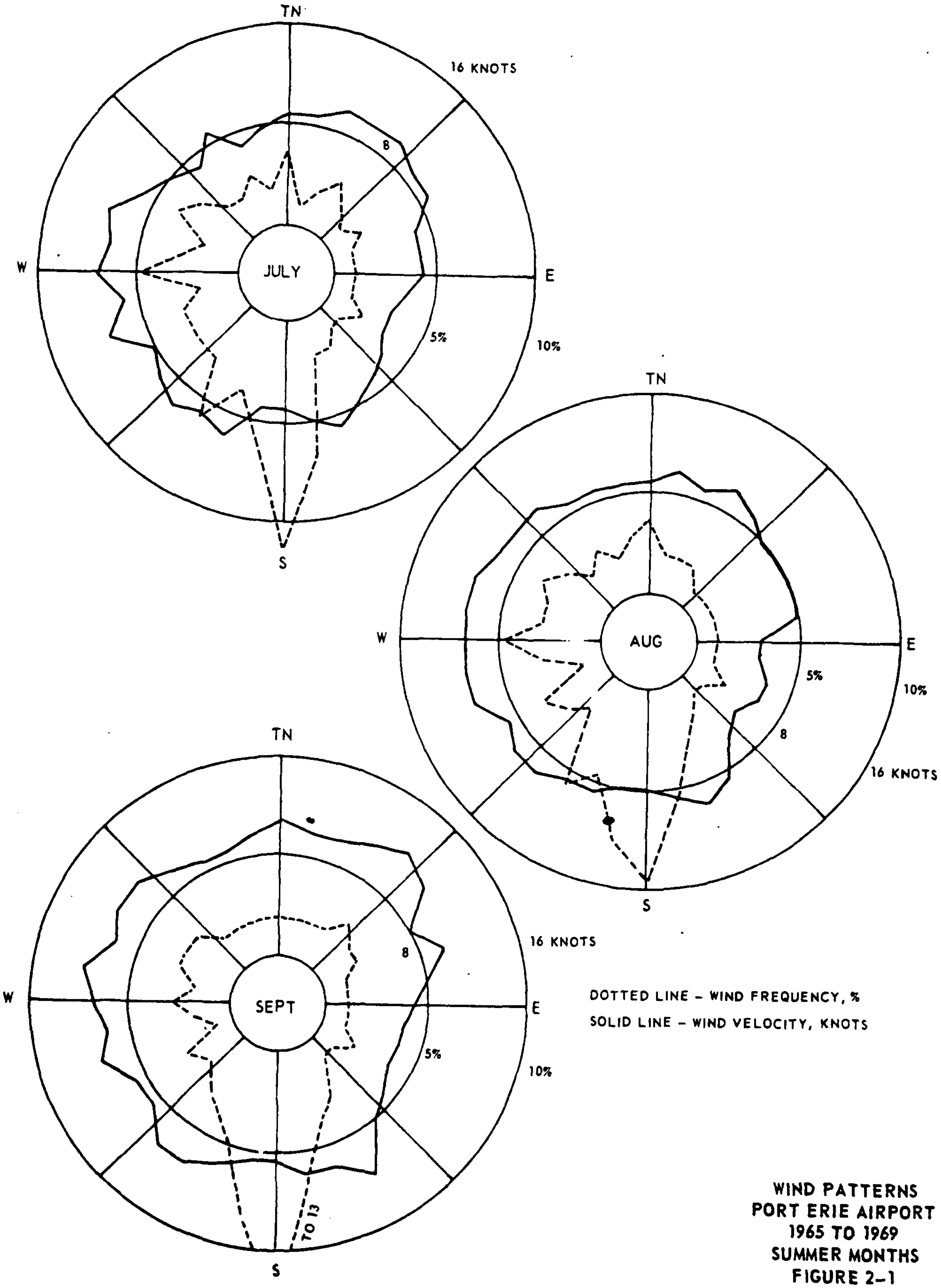
PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



DOTTED LINE – WIND FREQUENCY, %
SOLID LINE – WIND VELOCITY, KNOTS

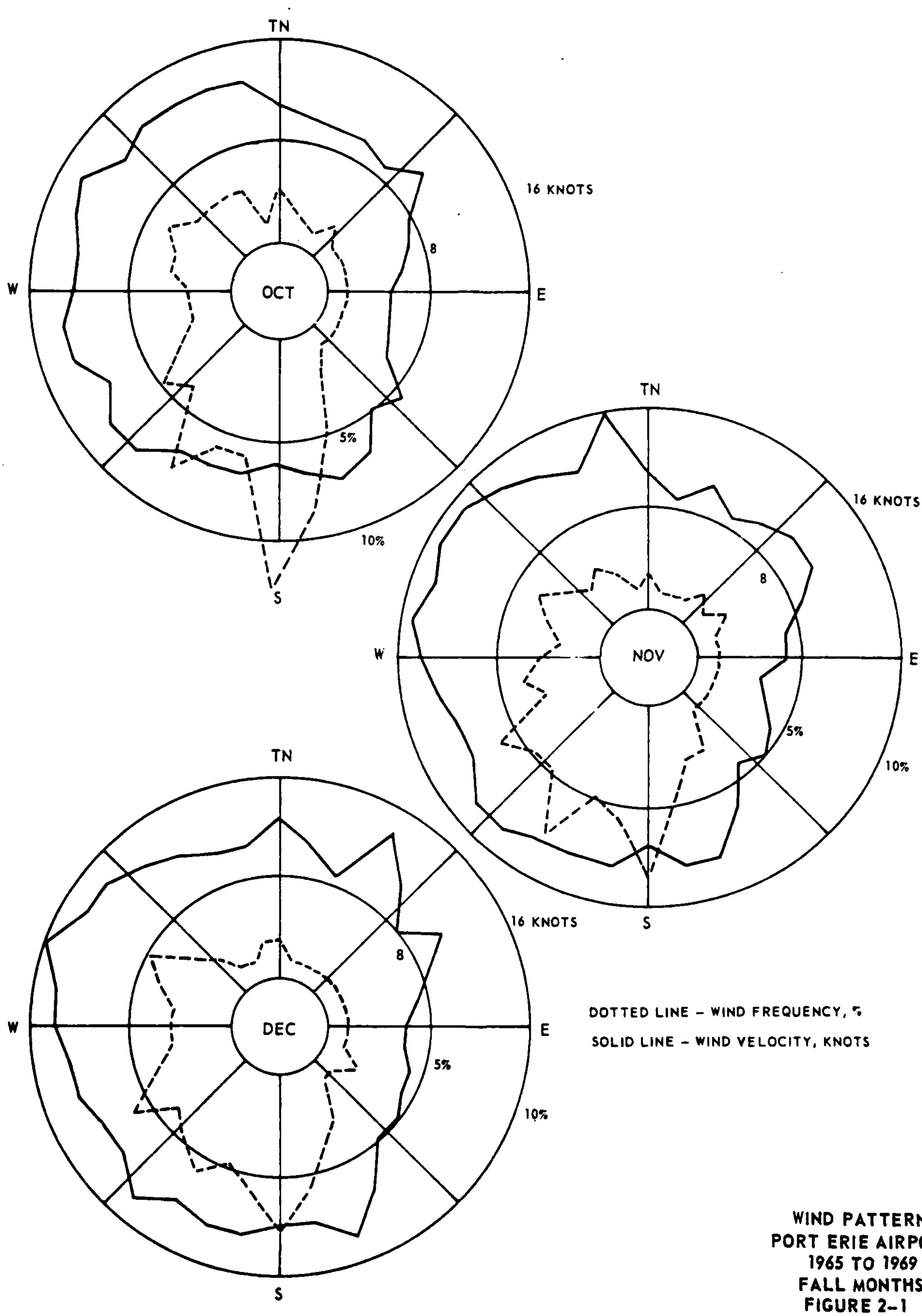
WIND PATTERNS
PORT ERIE AIRPORT
1965 TO 1969
SPRING MONTHS
FIGURE 2–1
SHEET 2 OF 5

PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



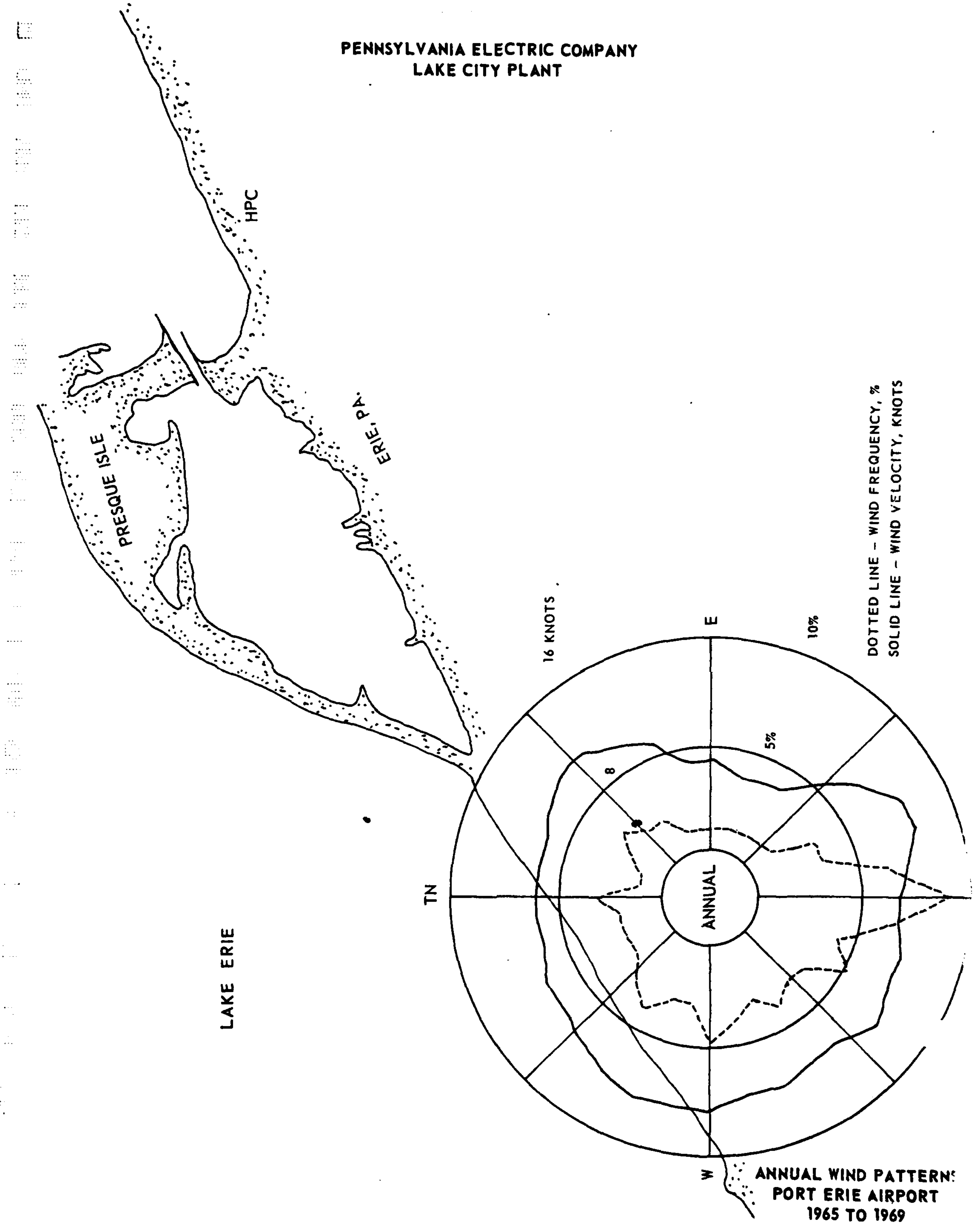
WIND PATTERNS
PORT ERIE AIRPORT
1965 TO 1969
SUMMER MONTHS
FIGURE 2-1
SHEET 3 OF 5

PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



WIND PATTERNS
PORT ERIE AIRPORT
1965 TO 1969
FALL MONTHS
FIGURE 2–1
SHEET 4 OF 5

PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



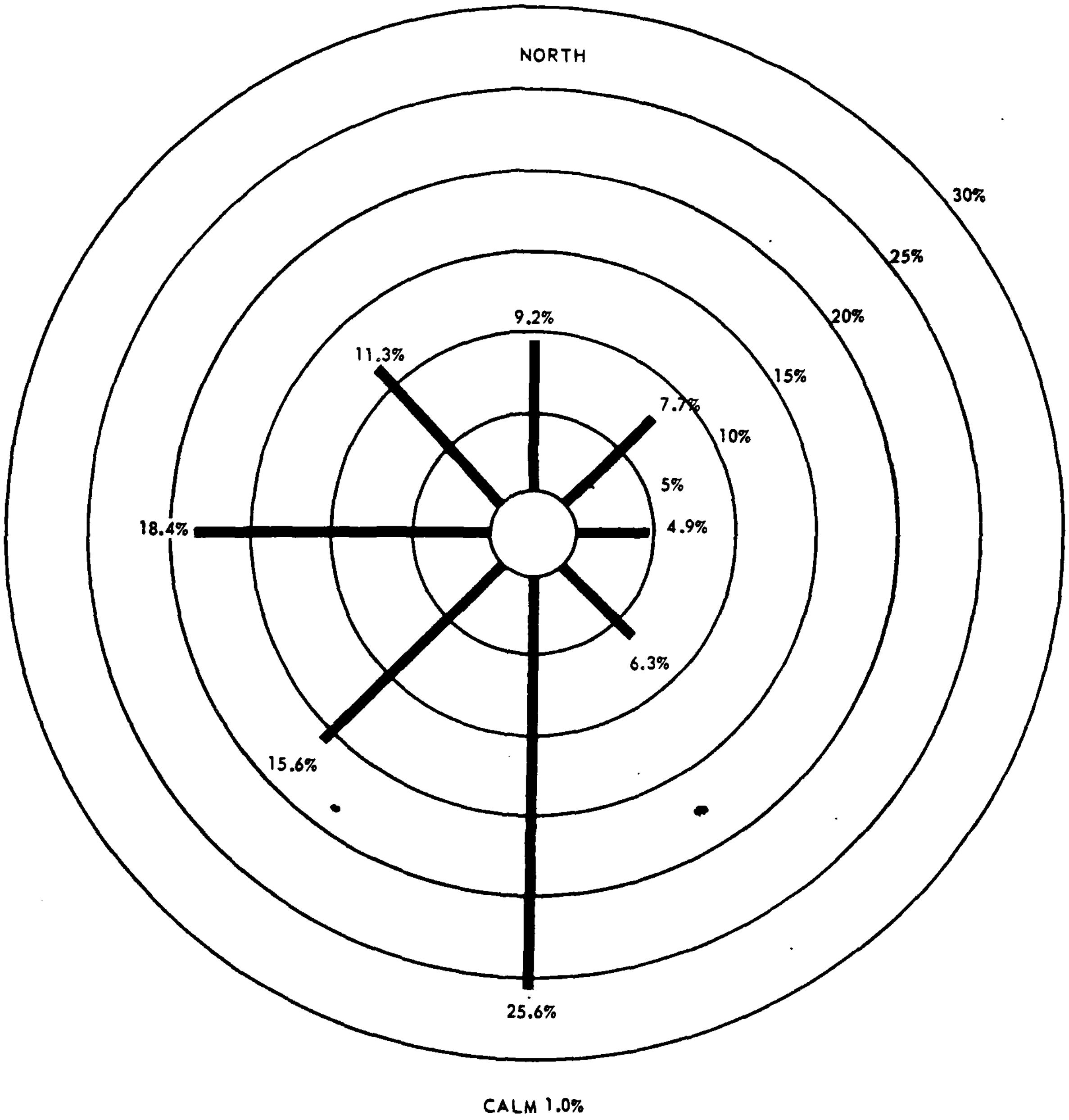
ANNUAL WIND PATTERNS
PORT ERIE AIRPORT
1965 TO 1969
FIGURE 2–1
SHEET 5 OF 5

FREQUENCY (%) AND MEAN WIND VELOCITY (V, Knots) OF WINDS RECORDED AT PORT ERIE AIRPORT, JANUARY 1965 TO MARCH 1969

Direction (°TN)	Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.		Sept		Oct.		Nov.		Dec.		Total	
	%	V	%	V	%	V	%	V	%	V	%	V	%	V	%	V	%	V	%	V	%	V	%	V	%	V
Calm	-	-	1	-	2	-	2	-	2	-	2	-	2	-	1	-	1	-	-	-	1	-	1	-	1	--
10	1	9	1	11	2	9	1	7	1	9	1	7	1	9	2	10	2	10	-	-	1	9	1	11	1	9
20	-	-	2	9	2	10	2	8	2	9	1	9	2	10	2	9	2	10	-	-	1	11	1	9	1	9
30	1	10	2	10	2	9	2	11	3	11	2	11	3	10	2	10	2	11	1	10	1	9	1	14	2	10
40	2	10	4	10	4	10	3	12	4	10	3	13	2	10	1	9	3	12	2	9	2	10	1	11	3	11
50	2	12	3	11	4	12	4	11	4	11	3	11	1	9	1	8	2	11	1	11	1	11	1	8	2	11
60	4	11	3	9	3	10	4	10	3	9	3	9	2	9	1	8	2	8	1	8	2	11	1	11	2	10
70	1	12	1	11	1	9	1	7	2	6	1	10	1	7	1	8	1	10	1	7	1	9	-	-	1	9
80	-	-	1	6	1	6	1	8	1	7	1	8	-	-	1	8	1	8	-	6	1	7	1	7	1	7
90	1	8	1	5	-	-	2	8	2	6	1	8	1	7	1	5	1	7	1	5	1	7	1	6	1	7
100	-	-	-	-	1	6	2	7	1	6	1	6	-	-	1	5	1	6	-	-	1	5	1	6	1	6
110	-	-	-	-	-	-	1	5	1	6	-	-	1	5	1	6	1	6	-	-	-	-	1	7	-	-
120	1	9	1	7	-	-	1	7	2	7	1	5	2	5	2	6	2	6	1	6	1	7	2	7	1	6
130	1	8	-	-	1	12	1	9	1	9	1	9	1	6	1	5	1	7	1	9	1	8	1	8	1	8
140	2	11	1	17	1	12	1	10	1	14	-	-	1	7	1	0	1	8	1	8	1	7	1	8	1	10
150	3	14	1	13	2	12	3	13	3	13	2	9	2	8	2	9	3	12	2	11	3	10	3	11	3	12
160	3	13	3	13	2	12	3	14	2	11	2	11	2	9	3	10	4	10	5	12	3	13	4	14	3	12
170	5	12	5	13	4	10	5	11	5	10	6	11	7	8	6	9	7	10	9	11	5	13	6	12	6	11
180	7	13	6	11	7	10	7	10	7	10	11	8	12	7	10	8	13	9	13	10	9	11	8	12	9	10
190	6	12	4	13	3	11	3	10	4	11	9	8	6	7	8	8	9	9	6	11	6	13	6	13	6	10
200	5	14	2	14	3	12	3	12	3	10	6	9	4	10	5	9	5	10	6	11	5	13	5	13	4	11
210	6	13	5	12	4	11	3	11	4	12	5	10	6	9	6	9	4	11	8	11	8	13	6	12	5	11
220	3	12	3	12	2	11	2	12	2	10	3	9	3	10	2	10	3	11	4	13	5	14	5	14	3	12
230	3	12	3	10	3	11	2	10	2	9	3	9	3	9	3	10	2	9	5	13	5	14	4	12	3	11
240	5	12	4	12	5	10	5	9	3	10	3	11	3	8	4	9	3	9	3	11	6	12	6	12	4	11
250	4	15	4	12	4	11	4	14	3	12	2	11	3	11	1	11	1	11	2	13	3	12	4	13	3	12
260	4	15	7	13	7	11	5	15	4	11	4	11	2	9	3	11	2	10	2	13	4	13	3	13	4	12
270	6	14	8	14	6	13	6	13	3	12	4	11	5	11	5	11	3	11	2	12	3	14	3	14	5	13
280	4	15	5	14	3	12	3	12	3	12	3	10	3	10	3	11	2	12	3	12	2	15	3	14	3	13
290	5	14	4	13	3	12	2	10	3	11	2	9	2	11	3	11	3	10	3	13	3	14	4	16	3	13
300	5	15	5	12	3	11	4	10	5	10	2	9	4	9	4	10	3	11	4	14	4	15	5	14	4	12
310	2	13	3	10	2	11	2	9	2	8	3	9	3	8	3	10	3	11	3	12	3	15	3	14	3	11
320	2	13	2	10	2	8	2	8	3	9	2	8	2	7	2	10	2	10	3	13	2	14	2	13	2	10
330	1	11	2	9	2	9	1	8	1	8	3	7	2	9	3	9	2	9	3	13	3	13	1	12	2	10
340	2	10	2	9	3	8	1	8	2	8	2	8	3	7	2	9	2	9	3	13	2	12	1	11	2	9
350	-	-	1	8	1	9	3	8	2	7	2	7	2	8	3	9	2	10	1	13	1	16	2	11	2	9
360	2	9	2	9	3	8	2	8	4	8	2	8	4	9	4	9	2	11	3	11	2	11	2	12	3	9

WINDS RECORDED AT
PORT ERIE AIRPORT
FIGURE 2-2

PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



WIND ROSE
FOR ERIE AIRPORT
JANUARY 1965 TO 1969
FIGURE 2-3

Climatological data for three stations around Lake Erie.

T - Toledo (Toledo Express Airport) Ohio, Latitude 41°36'N, Longitude 82°48'W
C - Cleveland (Cleveland Hopkins Airport) Ohio, Latitude 41°23'N, Longitude 81°51'W
B - Buffalo (Airport) N.Y., Latitude 42°56'N, Longitude 78°44'W

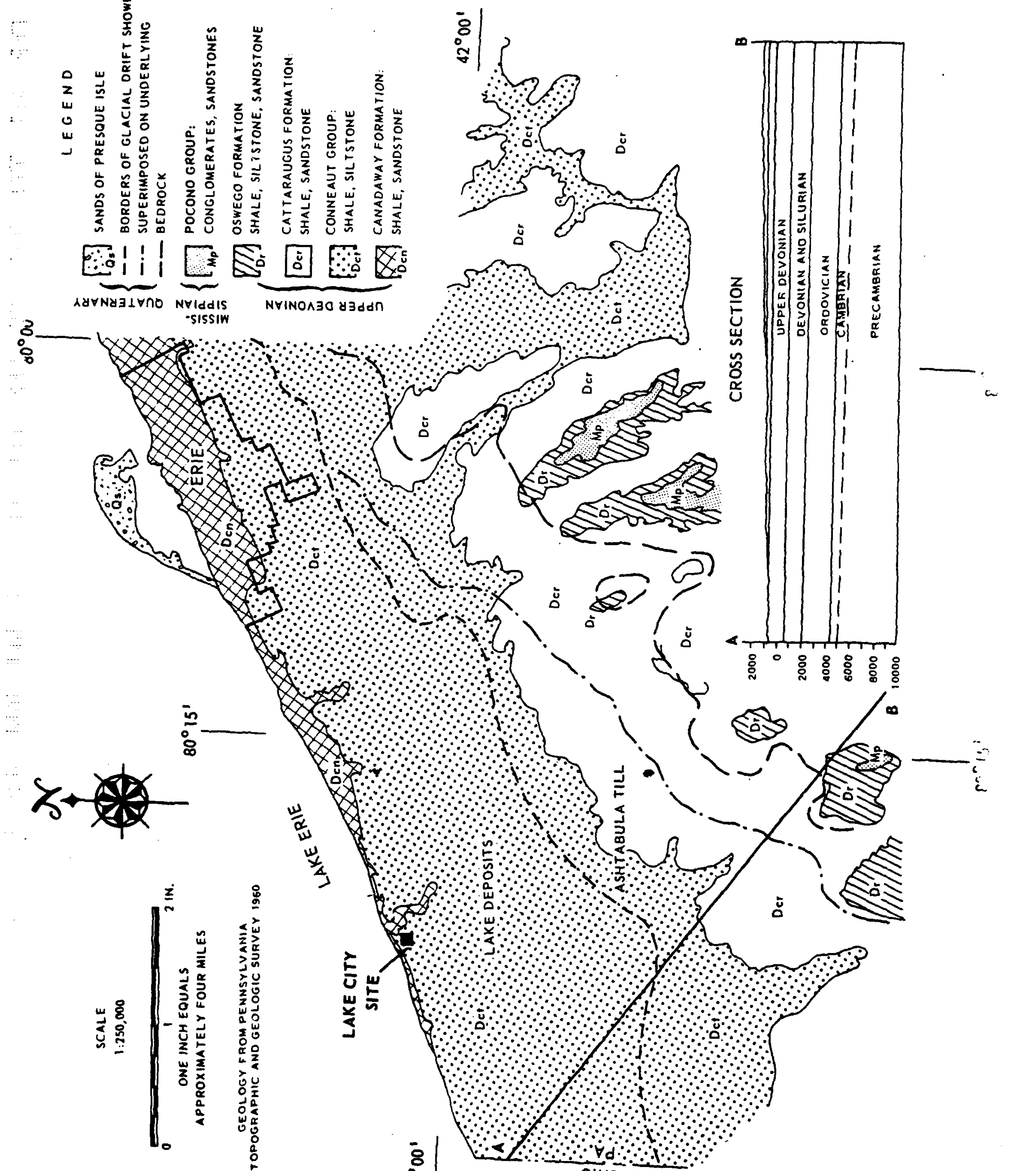
	Air Temp. (°F)			Wind						Precip. (inches)			Rel. Humidity (percent)		
	T	C	B	mph T	dir T	mph C	dir C	mph B	dir B	T	C	B	T	C	B
Jan	26.4	28.5	25.5	12.6	WSW	12.5	S	17.4	WSW	2.25	2.38	2.78	77	78	77
Feb	27.3	28.6	24.7	12.5	SW	12.5	S	16.4	SW	1.86	2.12	2.59	75	76	76
Mar	35.8	36.8	33.0	13.0	SW	13.0	WNW	15.9	SW	2.86	2.89	2.72	72	73	74
Apr	46.5	47.3	43.8	12.8	WSW	12.0	S	14.8	SW	3.25	2.73	2.55	69	69	70
May	58.2	59.1	55.4	11.0	ENE	10.5	S	13.2	SW	2.95	2.73	2.47	68	69	70
Jun	68.6	69.4	65.5	9.8	SW	9.5	S	12.5	SW	3.55	3.05	2.70	69	69	70
Jul	73.1	73.7	70.6	9.1	SW	8.9	S	12.1	SW	2.65	3.04	2.43	68	68	69
Aug	71.0	71.9	68.9	8.8	SW	8.5	S	11.7	SW	2.69	2.64	2.54	70	70	71
Sep	64.2	65.5	62.4	9.7	SW	9.5	S	12.8	S	3.02	3.13	3.01	72	71	73
Oct	52.7	54.4	51.2	10.5	SW	10.2	S	14.1	S	2.32	2.42	2.49	72	71	74
Nov	39.8	41.7	39.9	12.4	SW	12.8	S	16.4	S	2.15	2.66	3.09	75	74	74
Dec	28.9	30.9	29.0	12.3	SW	12.9	S	17.0	WSW	2.29	2.29	2.92	78	76	76
yr	49.4	50.6	47.5	11.2	SW	11.1	S	14.5	SW	31.84	32.08	32.29	72	72	73
(a)	(b)	(b)	(b)	77	9	16	8	62	8	(b)	(b)	(b)	17	16	18

(a) years of record or (b) 1921-50 mean.

Climatology and weather services of the St. Lawrence Seaway and Great Lakes, U.S. Dept. of Commerce, Weather Bureau, Technical paper #35, pp. 61-65, 1959.

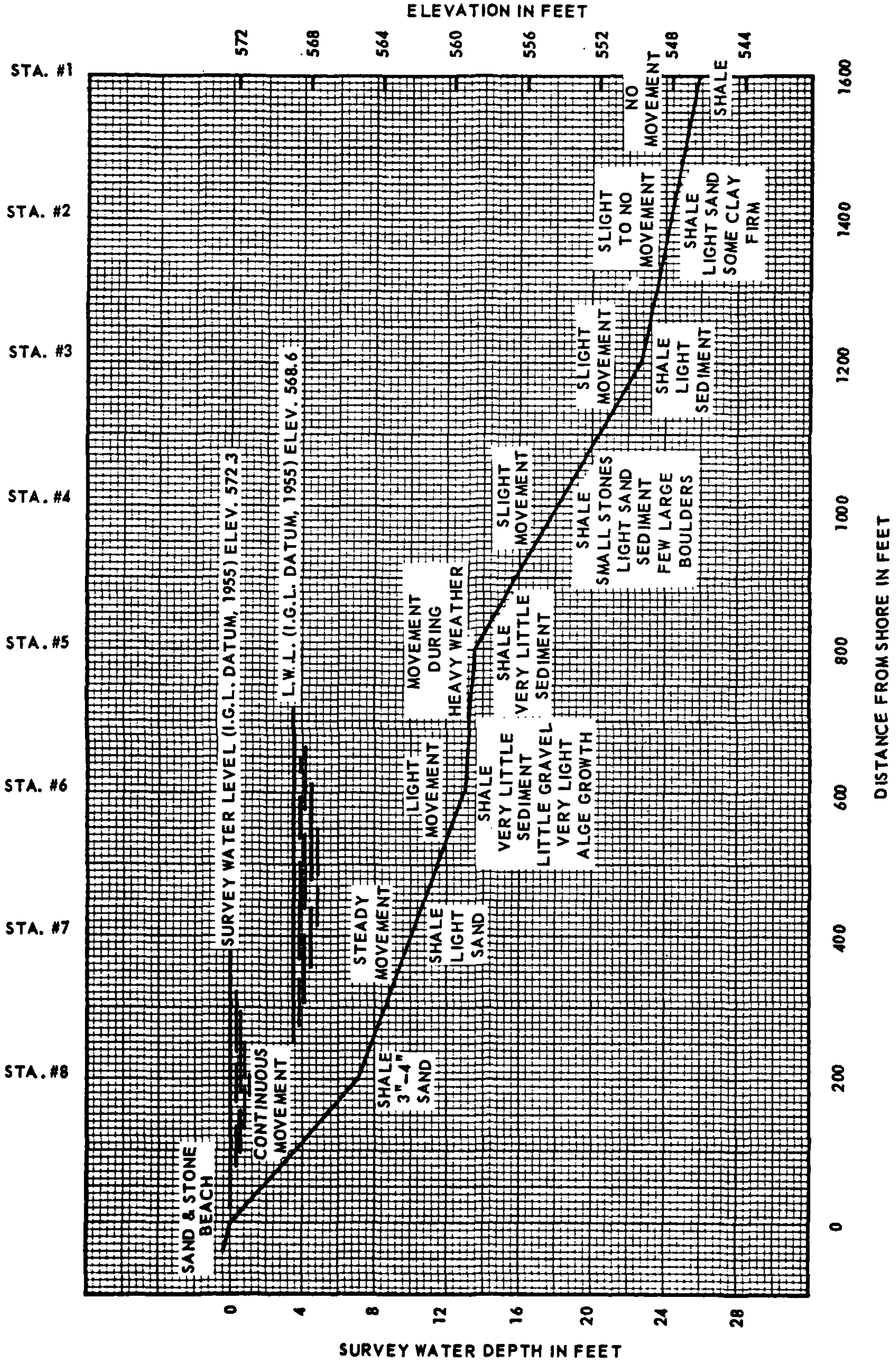
CLIMATOLOGICAL DATA
FIGURE 2-4

PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



GEOLOGICAL MAP
FIGURE 2-5

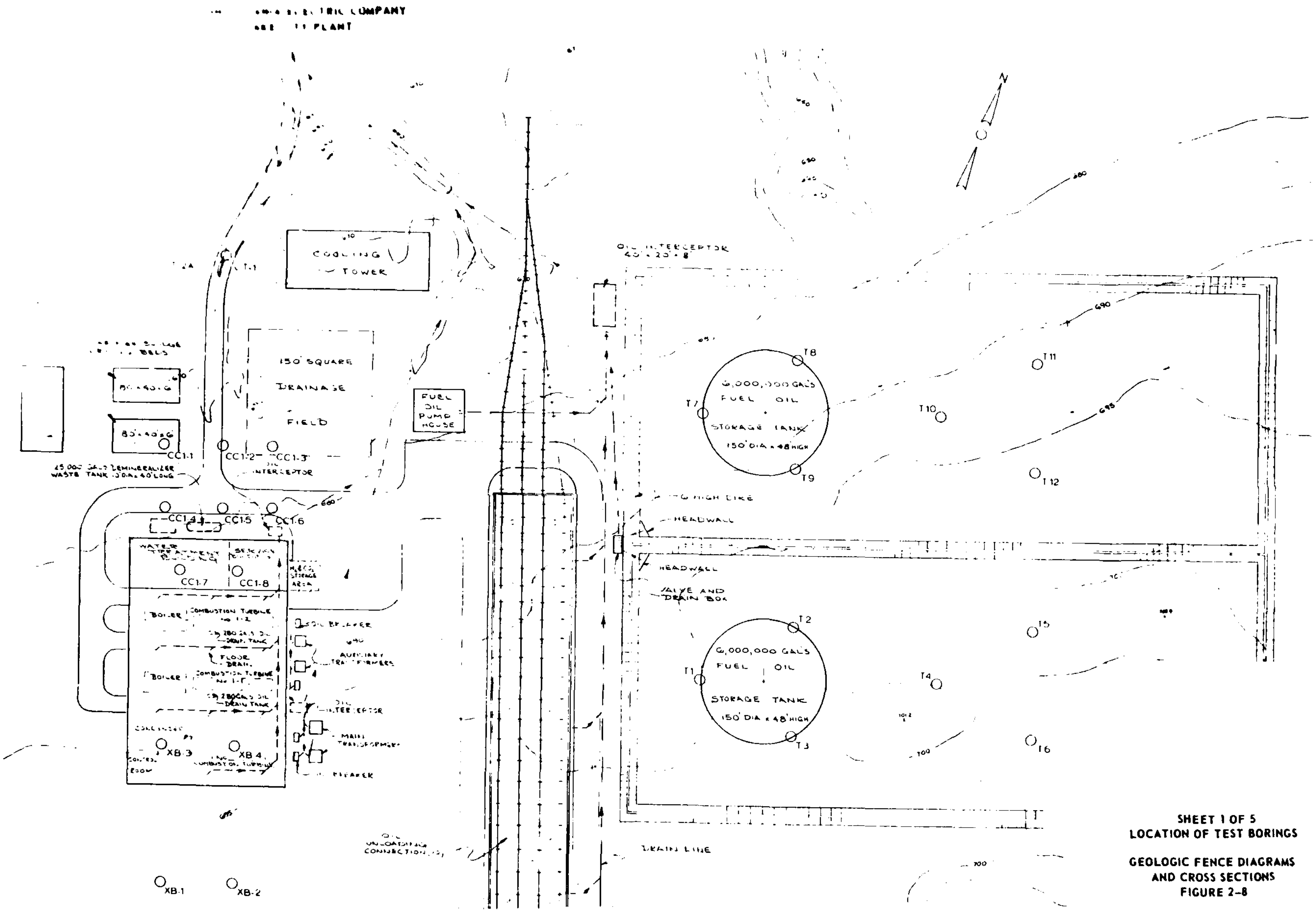
PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



BOTTOM PROFILE
FROM LAKE SURVEY
FIGURE 2–6

PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT

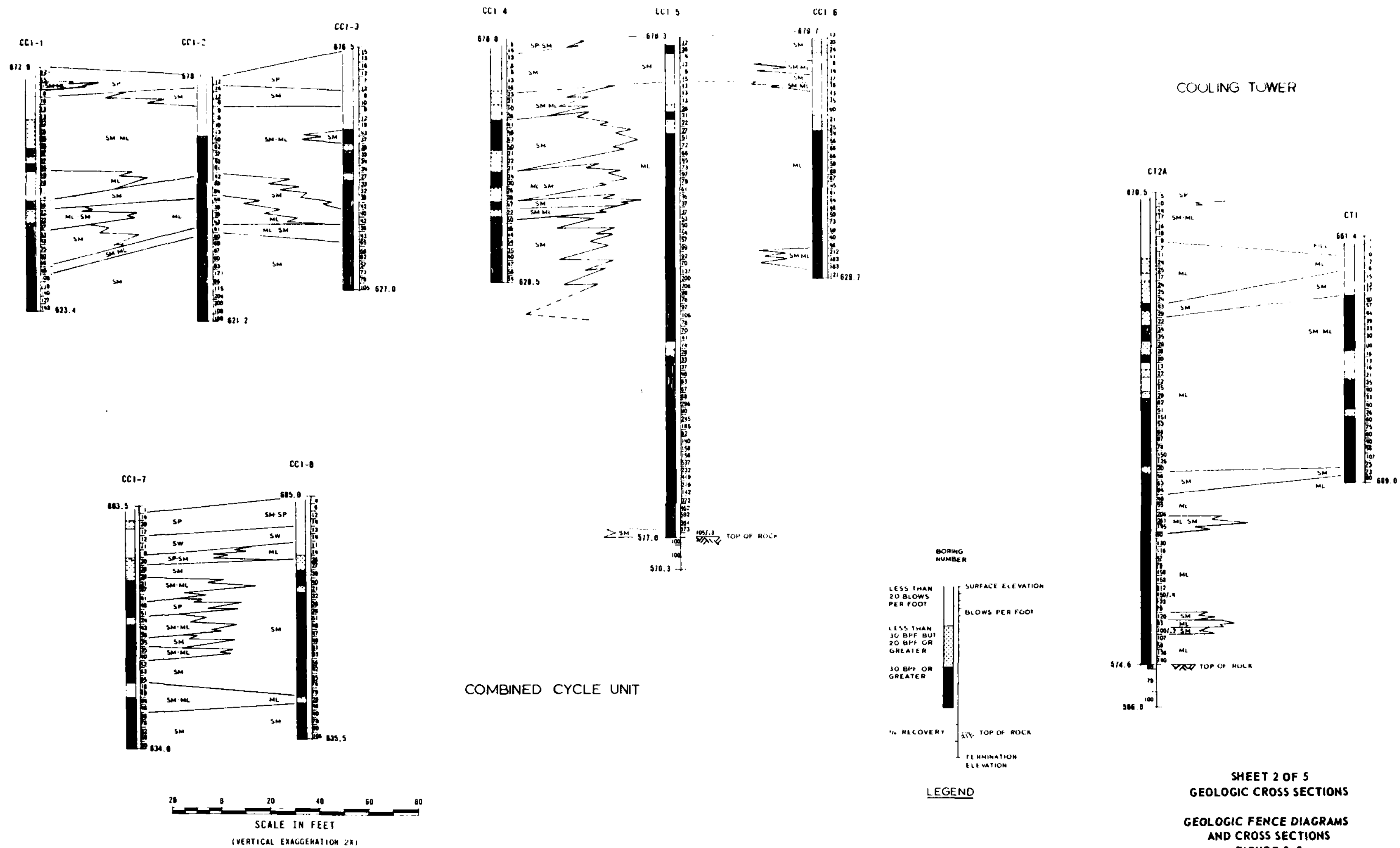
AERIAL PHOTOGRAPH OF PLANT SITE
FIGURE 2–7



SHEET 1 OF 5
LOCATION OF TEST BORINGS

GEOLOGIC FENCE DIAGRAMS
AND CROSS SECTIONS
FIGURE 2-8

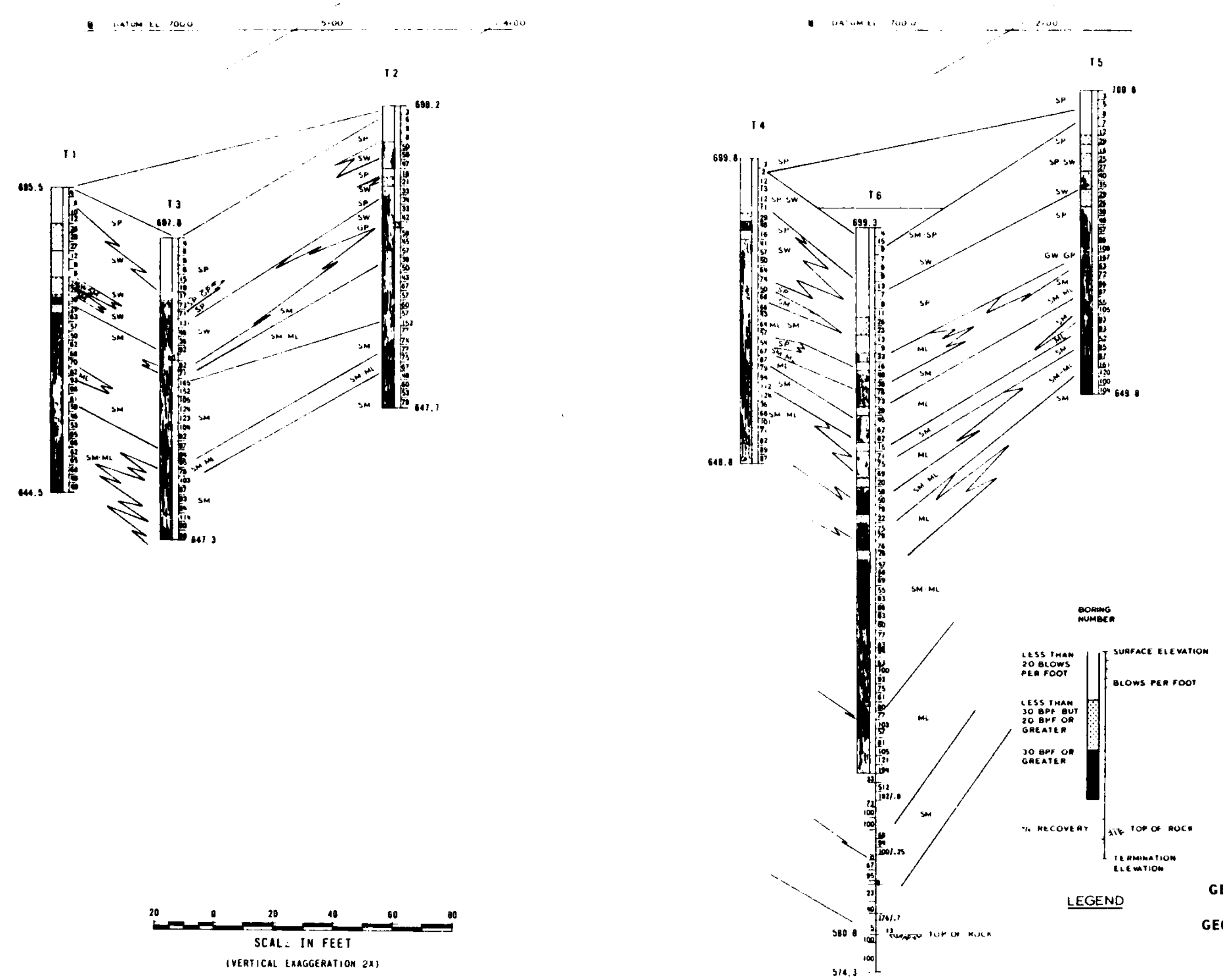
PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



SHEET 2 OF 5
GEOLOGIC CROSS SECTIONS

GEOLOGIC FENCE DIAGRAMS
AND CROSS SECTIONS
FIGURE 2-8

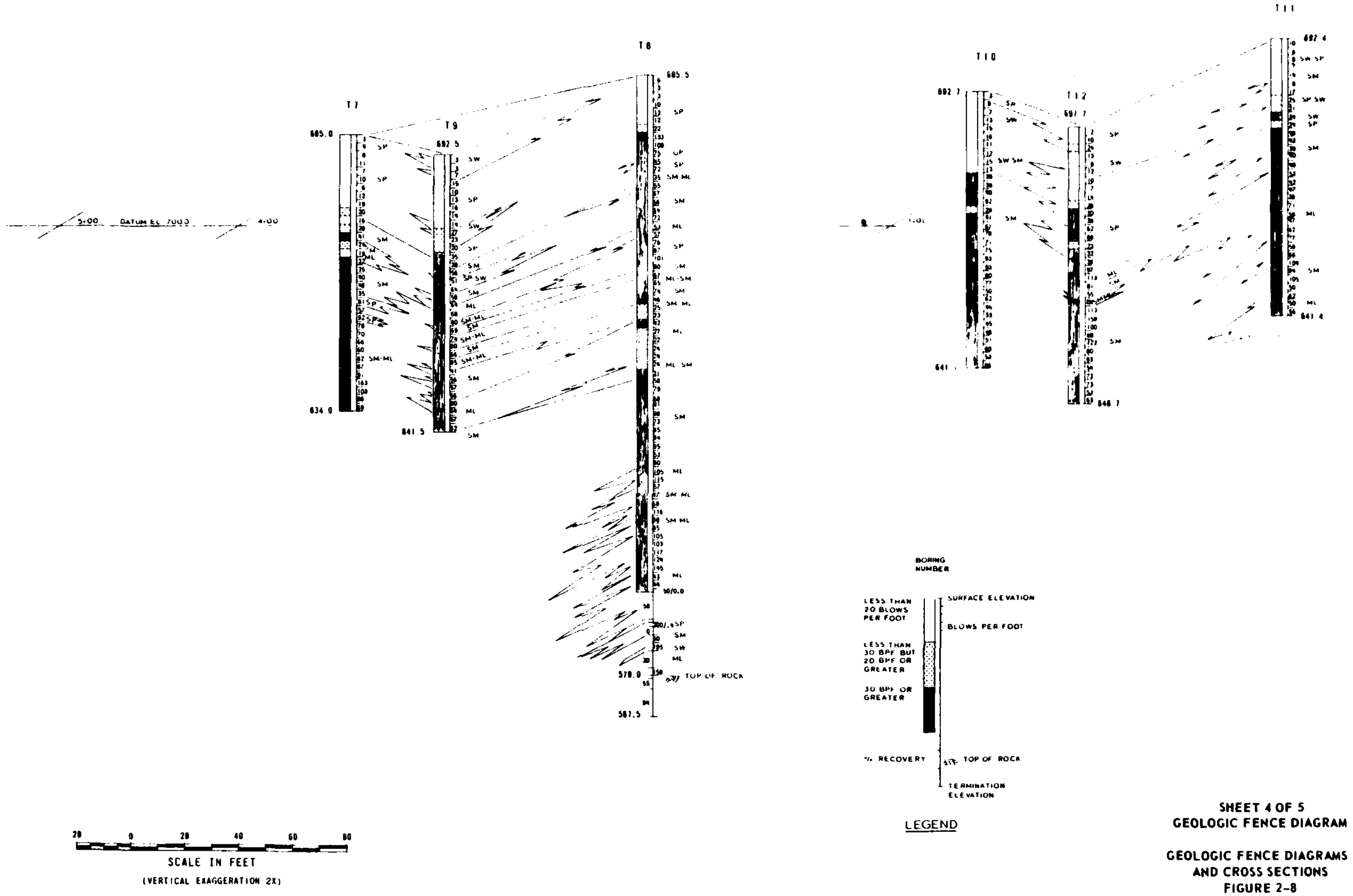
PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



SHEET 3 OF 5
GEOLOGIC FENCE DIAGRAM

GEOLOGIC FENCE DIAGRAMS
AND CROSS SECTIONS
FIGURE 2-8

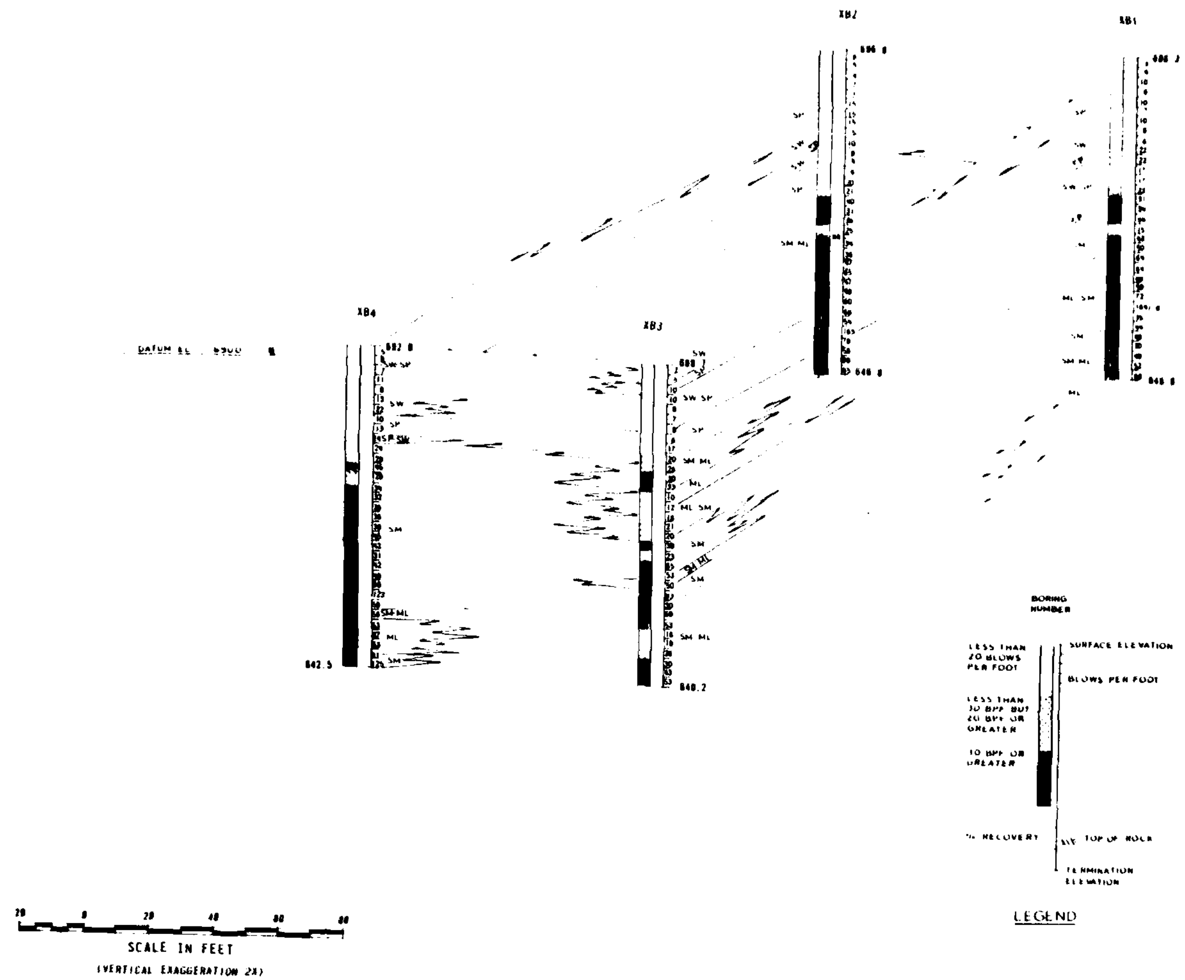
PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



SHEET 4 OF 5
GEOLOGIC FENCE DIAGRAM

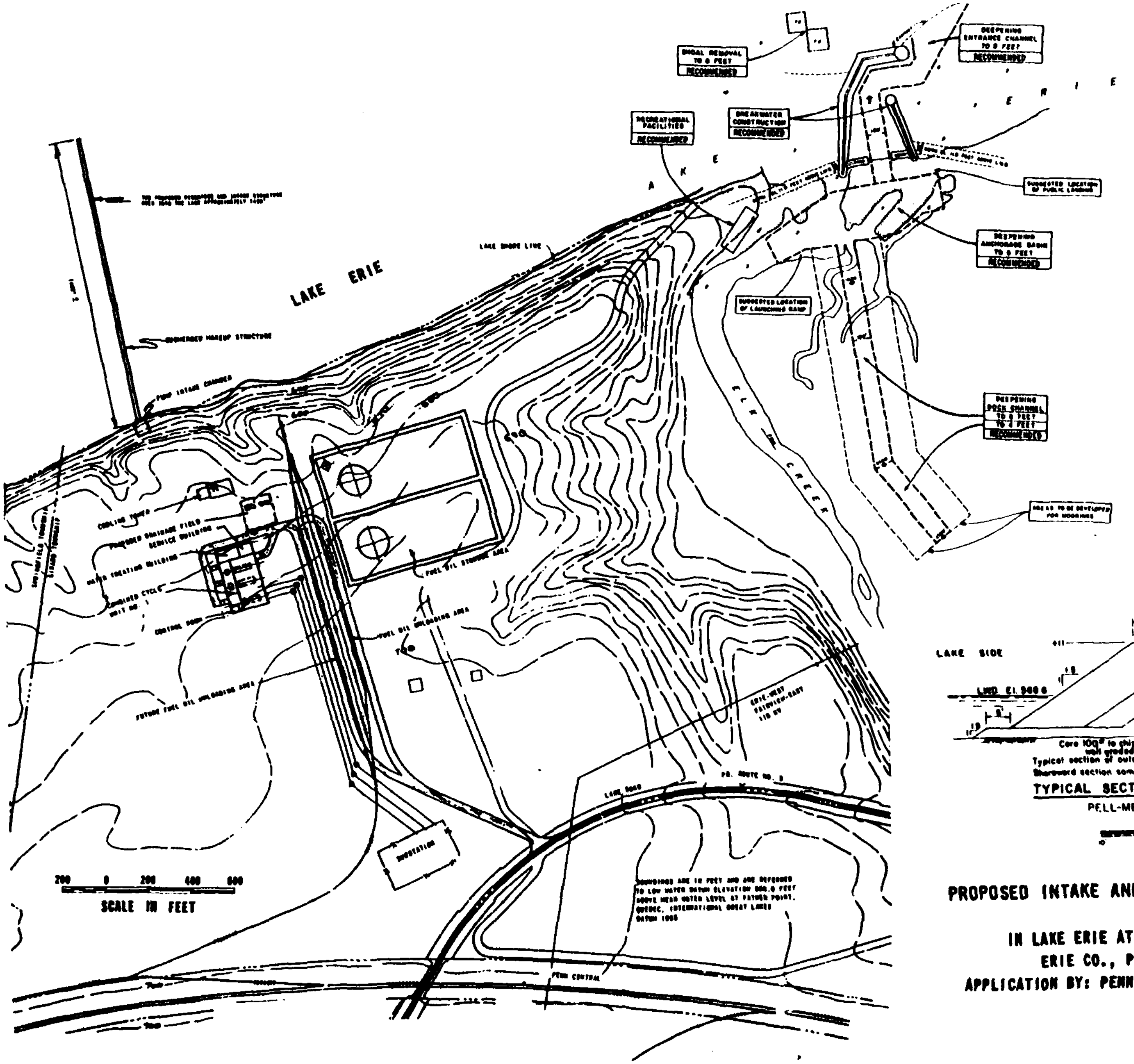
GEOLOGIC FENCE DIAGRAMS
AND CROSS SECTIONS
FIGURE 2-8

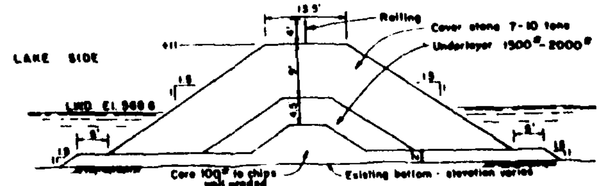
PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



SHEET 5 OF 5
GEOLOGIC FENCE DIAGRAM

GEOLOGIC FENCE DIAGRAMS
AND CROSS SECTIONS
FIGURE 2-8





Typical section of outer 325 feet.
Shoreward section same as East Breakwater section

TYPICAL SECTION - WEST BREAKWATER

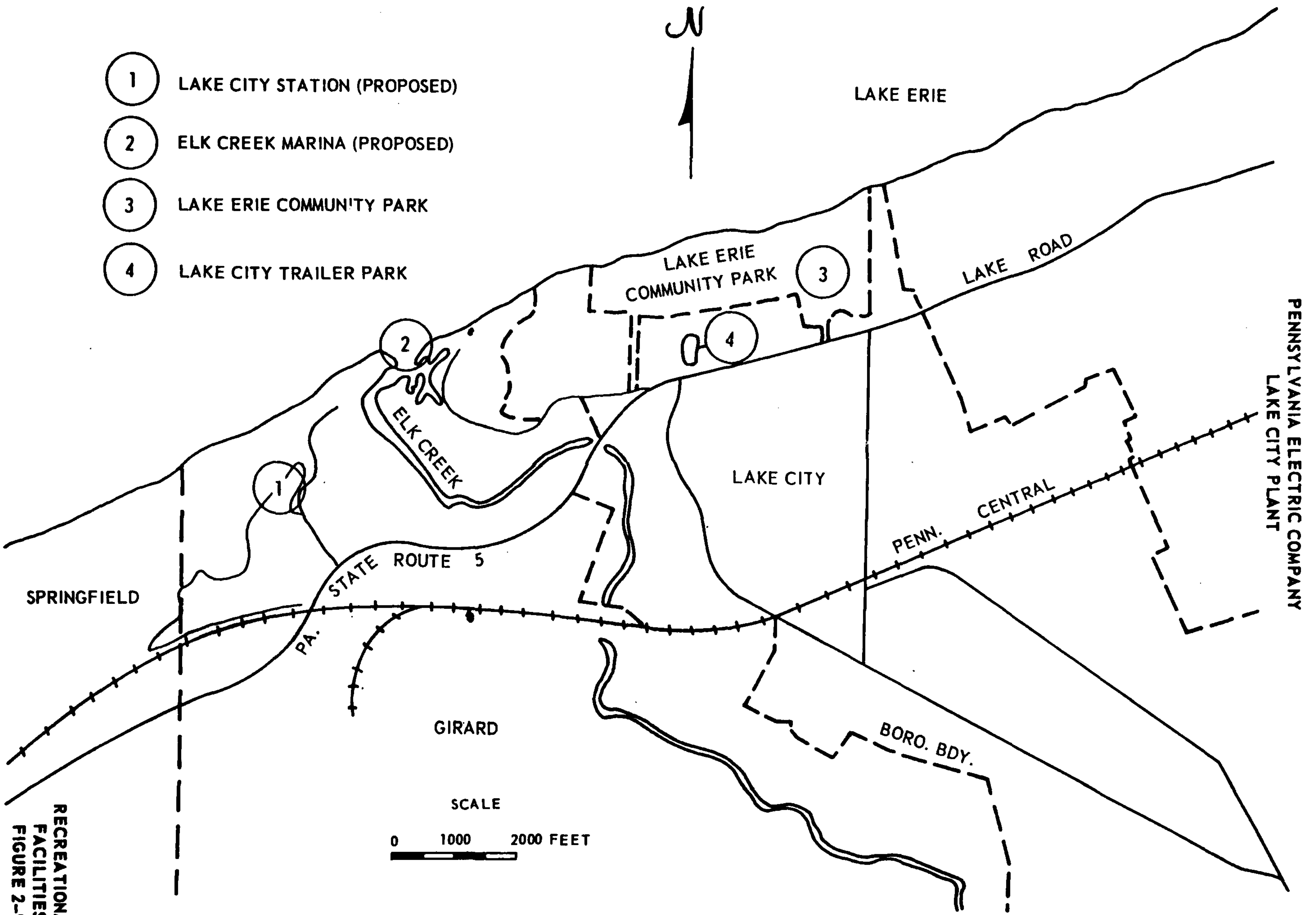
PELL-MELL CONSTRUCTION

SCALE OF FEET

PROPOSED INTAKE AND OUTFALL STRUCTURE

IN LAKE ERIE AT GIRARD TOWNSHIP
ERIE CO., PENNSYLVANIA
APPLICATION BY: PENNSYLVANIA ELECTRIC CO.

FIGURE 2-10



RECREATIONAL
FACILITIES
FIGURE 2-9

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3 ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION

3.1 CONSTRUCTION PHASE

3.1.1 Offshore and Shoreline Construction

3.1.1.1 Estimated Dredging and Blasting Impact

Dredging or blasting required for installation of the intake and discharge pipes will have a temporary impact on the bottom community within the immediate area. The impact would involve removal of bottom organisms within the trench area, temporarily increased local turbidity, and some sedimentation. The area from which bottom organisms (Section 2) would be removed is insignificant compared to total shoreline area. Therefore, regardless of the time of year, the food chain of the aquatic community will not be significantly affected. Increased turbidity will be temporary, and therefore will not affect productivity of aquatic plants. Fish, which can tolerate high turbidities for short periods of time, will not be affected adversely (Reference 3.1-1). Sedimentation, if it is continuous and severe enough to cover eggs or clog the gravel crevices which afford protection in natural habitats, affects spawning of fishes which require gravel bottom for egg and fry development. Damage to eggs and fry can be avoided by dredging at a time of the year when spawning of important species does not take place in the immediate vicinity. For this plant, the area subjected to sedimentation will be very small compared to the shoreline area available for spawning.

When blasting is used, there is the possibility of fish mortality in the immediate area.

The species of fishes listed on Table 2-6 are expected to be in the area through much of the year or during spawning, as indicated. The incidence of spawning in the area is not known, although the Pennsylvania shoreline on the whole is used. A light growth of algae was noticed at a depth of 13 feet offshore, and was not limited to one particular area at the site.

3.1.1.2 Protective Measures

Control of dredging will be maintained so as to be in conformance with the requirements and stipulations of the State and Federal permits.

Dredging and blasting will disturb the bottom life temporarily. However, by limiting the amount of dredging and blasting, the damage will be temporary in nature. This work will not present an extensive or continuing barrier to fish or other bottom life migration or movement.

Material from the open trench will be used as backfill and the area raised twelve inches above the natural bottom to protect the pipeline. Additional dredged material left over after backfilling will be spread along the pipeline route, 15 feet on each side not to raise the bottom more than 12 inches above its natural depth. Any material too large to be used in this manner, will be disposed of on the site. This material will be placed in a basin so that the liquid and sediment will separate and the water will be allowed to return to natural drainage channels. The remaining sediment will be covered, shaped and seeded to conform to the surrounding terrain.

3.1.2 Onshore Construction

3.1.2.1 Estimated Site Preparation and Construction Impact

Since construction of this type of facility requires removal of some wooded areas, there will be disturbance to indigenous wildlife. The amount of wooded areas to be removed is small, and large wooded areas which remain adjacent to the plant site should provide adequate relocation area for the wildlife. The total area to be cleared or graded will be 66 acres.

Presently the drainage pattern on the east end of the site consists of drainage into Elk Creek and into Lake Erie. It is not contemplated that the amounts of surface drainage entering Lake Erie directly will be changed.

The basic change in the drainage of the site will be runoff time; i.e., the time between the rain falling on the ground and its entering Lake Erie. This time will be decreased.

At present, the surface runoff carries some sediment load into Elk Creek and Lake Erie from the adjoining agricultural areas. The planned sediment control facilities which will control the sediment for the immediate plant site only and are described in the following protective measure section, will trap the sediment prior to its entry into Lake Erie. The sediment basins will be cleaned, removing the sediment, as part of plant maintenance. The sediment removed will then be placed on the site and seeded. A study of a series of aerial photographs taken between 1939 and 1972 shows no apparent erosion of the bluff at the site. It is not expected that the planned construction will cause any change in the erosion of the bluff, or have any impact on the soils, geology or ground water regimes in the area.

Rain falling in the oil tank dike area will be drained by ditches around the perimeter of the tanks to an outlet point, one for each side of the divider wall. The drainage will be ponded in the diked area by valving the outlet. This water will then go to the oil interceptor prior to lake discharge. The pond area is not drained however, until a manually controlled valve is opened. In this manner, a visual assessment of the amount of oil can be made. If the oil in the pond is of a magnitude too great for the oil separator to handle, the oil will be contained and removed within the berm walls (See figure 1-3).

The release of combustion products to the atmosphere during construction, particularly from diesel engines, is common to all construction projects. This is presently unavoidable, however the concentrations and quantities of the combustion product releases on this project are not expected to be significant.

During the construction phase of this plant, noise will be made. The types of noise are those generally associated with large earth-moving equipment, pile driving equipment, cranes, concrete placing, and similar equipment.

The materials for construction will be transported to the site by either truck or by railroad cars which will respectively utilize the access road or the railroad spur. The planned railroad spur onto the plant site, plus a well designed main access road should provide adequate entry and egress from the property for all construction equipment, materials, and stationary plant equipment; and therefore, no significant impact is expected on adjacent traffic.

3.1.2.2 Protective Measures

The clearing and grubbing will be limited to only those areas needed for construction of plant facilities.

It is planned to remove only a small part of the existing wooded area on the site, since the portion of the property to be occupied by the plant, cooling tower, tanks, and access corridors is presently open fields.

A determined effort is being made during plant layout and will be made during construction to maintain the site's present natural condition.

The approach to be used in determining the amount of earth-moving required is the policy of using all those materials, that will be excavated and found suitable from good engineering practice, in the areas that need to have a fill or an embankment constructed on them. In this way, a minimum of area will

be disturbed and disposal areas will not have to be established.

Since site preparation requires removal of vegetative cover, some soil erosion may result. Several methods will be utilized to limit and reduce the amount of soil erosion. The area that is to be cleared of vegetative cover will be limited to only those areas that are required for immediate construction. However, these areas will be left with cover on as long as practicable. Erosion in the form of dust from construction parking areas and access roads will be controlled by sprinkling with water.

Erosion caused by rainfall on the balance of the site will be controlled by one of two methods, either maintenance of the vegetative cover or by sediment control facilities. The existing vegetative cover will be maintained or replaced after local construction by one which grows rapidly. Sediment control structures such as sediment ponds, ditching, and a storm drainage system will be employed to control erosion over large areas during construction. The storm drainage system will remain as part of the permanent installation.

The main plant access road will be oriented to the public highway so as to provide optimum conditions for entering and leaving the public highway.

Suitable facilities will be provided for the disposal of sanitary wastes, see Appendix C1.4, in accordance with Erie County and Pennsylvania State standards. A permit for these facilities has been issued by the Erie County Department of Health (Permit #163971). Liquid fuels, lubricating oils, and other wastes will be stored, handled, and disposed of in compliance with the Pennsylvania Fire Marshal and Pennsylvania Department of Environmental Resources regulations. A permit for above ground storage tanks has been issued by the Pennsylvania State Police (Permit #173,290). The Department of Environmental Resources has issued an Industrial Waste Permit (Permit #2572205).

3.1.3 Dewatering and Equipment Test Water

3.1.3.1 Sources and Disposal Protective Measures

Sources of dewatering water would be excavations for foundations for structures which would intercept ground water or Lake Erie infiltration. Structures at which this will occur are foundations for combustion and steam turbine units and cooling tower. The water from the pump house area, which is located at the lake front, will be pumped back to the lake, but extra care will be taken to ensure that only clear lake water will be returned to the lake. Sources of equipment test water would be that water used in pressure testing of the boiler and piping in the station, and the water for hydro-testing of the fuel oil storage tanks.

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ENVIRONMENTAL STATEMENT, LAKE CITY STATION, UNIT ONE.(U)
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The water obtained from dewatering of foundations will be disposed of via the site drainage facilities. The water will contain suspended soil particles which will be allowed to settle out in sediment basins prior to being discharged to a natural water course.

All equipment testing water having oils or chemicals will be collected and conducted to a settling pond where the oil will be removed and the chemicals neutralized prior to the water being discharged to a natural water course.

3.1.4 Potential Construction Accidents

3.1.4.1 Types

The only three types of potential construction phase accidents expected to have an environmental impact would be:

a. Fires - air pollution

b. Explosions - noise impact

c. Oil spills - ground or water pollution

3.1.4.2 Protective Measures

An on-going safety program will be utilized during construction to educate employees in safety practices and concepts, and to maintain a continuous management level surveillance for all potentially hazardous conditions and situations.

Portable fire extinguishers will be distributed around the construction activities for immediate use in containing accidental fires. Major fires would require assistance from local fire companies. After the plant water supply and storage system is constructed and operable, it will be available to supply water to permanently mounted fire hose reels.

Oil spills of a large magnitude will not be encountered since only routine refueling of motorized construction equipment is planned.

3.2 OPERATION PHASE

3.2.1 Air

3.2.1.1 Estimated Impact

3.2.1.1.1 Emissions

The composition of the exhaust gases from Westinghouse's PACE 260 plant will vary depending on whether this is operating as

a simple or a combined cycle, and the type of fuel used. Based on ASTM No. 2 fuel oil with 0.5 percent sulfur content, the maximum allowable, the predicted amount of SO_2, NO_x, and particulate are as follows for normal base load operation. See Appendix A.

The Pennsylvania State limits on these emittants are also given for comparison. It should be noted that the new EPA stationary source criteria are not applicable to combustion turbines.

Emissions	Heat load Base Btu/hr	Combustion Turbine Cycle	Auxiliary Duct Burners	Combined Cycle	Penna. Limit	Federal Max. (lb/MBTU) 2 Hr. Avg.
		1.775×10^9	0.354×10^9	2.129×10^9	-	-
SO_2	$lb/10^6 Btu$	0.52	0.52	0.52	1.8	0.80
NO_x	$lb/10^6 Btu$	0.72	0.23	0.64	-	0.30 (not include combustion turbine)
Particulate	$lb/10^6 Btu$	0.017	0.014	0.016	0.1	0.1

Therefore, it can be seen that the March, 1972 Pennsylvania state limits will be met.

3.2.1.1.2 Impact of Ground Level Concentrations

It is expected that emissions from this plant will have no or only minimal impact on plants and animals in the surrounding area and will conform to all Federal and State ambient air quality standards under all operating modes and atmospheric operating conditions as illustrated in Appendix A. In addition, plan approval of combustion units has been received from the Pennsylvania Bureau of Air Quality and Noise Control (Permit #25-306-106)

The maximum ground level concentrations of air pollutants (as derived in Appendix A) expected downwind from the Lake City Plant are less than the values which have been demonstrated in other studies to have possible effects on plants and animals. These values are summarized as follows:

Pollutant	Max. Expected Ground Level Concentration		Animal Effect Point	Plant Effect Point
	Mgm/M_3	ppm	ppm	ppm
SO_2	142.8	0.054	5.0	0.24
NO_x	124	0.062	0.5	0.5
Particulate	3.2		Not Defined	No Effects Unless Crusted

The sulfur dioxide emissions from the Lake City plant will probably cause no damage to vegetation in the area. The concentrations could at most cause some chronic injury, consisting of chlorosis and retardation of growth, symptoms which have appeared in the field at low concentrations after prolonged periods of exposure. Alfalfa, one of the plants most sensitive to sulfur dioxide, has been calculated as being able to withstand concentrations of 0.24 ppm indefinitely (Reference 3.2-4). Considering no other factors but sulfur dioxide, this species, then, should sustain only slight, if any, injury at the theoretical 0.054 ppm concentration at the point of maximum concentration downwind from the emission source. The Lake City Plant emissions of sulfur dioxide will not cause significant lung damage or mortality to animals since the predicted maximum downwind concentration of SO_2 is only 0.054 ppm.

3.2.1.1.3 Effects of Particulates on Plants and Animals

The particulate emissions from the Lake City Plant should not reach concentrations high enough to affect animals in the vicinity. In addition, Federal and State Ambient Air Quality Standards for particulates will be met with a wide margin.

3.2.1.1.4 Effects of NO_x on Vegetation

It is possible that some slight damage could occur to vegetation in the vicinity of the Lake City Plant emission source due to NO_x and its reaction products. Probably, the damage would be restricted to slight growth suppression at the very low (less than standards) ground concentrations of 0.06 ppm predicted.

Conifers, which are very sensitive to NO_x are scattered sparsely throughout the deciduous woods on the site. There are no conifer stands located on or adjacent to the site.

3.2.1.1.5 Estimated Smoke Opacity

The predicted smoke level at 100 percent load with No. 2 fuel oil will produce a Bacharach smoke number between 4 and 4.8. At this level the exiting gas is barely visible. As the load factor is reduced in the plant, a corresponding reduction in Bacharach smoke number will result.

Limits on visible stack emissions in both State and Federal level begins at 20 percent opacity and above. The 20 percent opacity is equivalent to number 1 in the Ringleman scale and the predicted Bacharach number of 4 to 4.8 at 100 percent load is equivalent to an opacity of 11 to 16 percent.

3.2.2 Water

3.2.2.1 Estimated Impact

3.2.2.1.1 Effluent Quality

The water discharging back to the lake during normal operation will consist mainly of cooling tower blowdown mixed with a small percentage of demineralizer waste. The demineralizer waste will be treated and mixed with the cooling tower blowdown at a predetermined rate to ensure that the discharge will be within the limits of the current Pennsylvania Department of Environmental Resources regulations. The Department of Environmental Resources has issued an Industrial Waste Permit (Permit #2572205) which is an approval of the plant discharge water quality.

Areas which would contribute pollution via accidental discharge have been considered. Provisions to prevent such discharge from entering the lake will be provided for by: diking around large outdoor storage tanks and retainer walls around smaller indoor chemical storage tanks. An oil interceptor will monitor and remove any trace of oil which could occur at the fuel oil unloading and storage areas. The waste water characterization is discussed in Appendix C.

3.2.2.1.2 Diffusion Zone Generation

When the heated blowdown will be discharged from a multiple port diffuser into a receiving water of greater density, the blowdown will be diluted by turbulent jet mixing. (See Appendix B for detailed discussion).

After the blowdown has been initially diluted, there will develop an almost homogeneous mixture in the vicinity of the point of discharge.* With the passage of time, this mixture of blowdown water and lake water, that will be called the

*See Figure 1-6

blowdown diluted effluent field, will begin to drift away from the point of discharge with the prevailing lake currents. As the blowdown diluted effluent field drifts, it also will begin to spread in the shape of a plume, the temperature of which will be less than two degrees greater than the lake temperature. (See Figure 1-6). The diffusion zone will be located approximately 1350 feet from the lake shoreline.

The diffuser will be oriented in a direction N 20^{o} W, perpendicular to the predominant lake currents (References 3.2-8 and 3.2-9) to achieve maximum dilution. A port diameter of 2-1/2 inches will be used for the total length of the diffuser and the ports will be spaced on 10 foot centers. To minimize interference between adjacent buoyant jet plumes, the ports will discharge horizontally and alternatively to opposite sides of the diffuser.

The Outfall-Diffuser System Feasibility Study for the Hammermill Paper Company (Reference 3.2-8)indicates that in the area of the lake located east of Presque Isle Peninsula, the lake water currents are greater than 8.65 feet per minute 80 percent of the time, since this velocity is the maximum water current at which a stratification layer with a 2^{o}F differential can be maintained. Therefore, stratification of the diluted effluent plume will be possible 20 percent of the time. (Reference 3.2-7 and 3.2-10). However, the lake water currents at the unprotected shoreline at the plant site will be larger than these encountered in Erie, Pa. in the protected area east of Presque Isle Peninsula where the Hammermill Paper Company has its outfall diffuser, and therefore it can be concluded that epilimnetic stratification will only be possible a small part of the time. (See Appendix B for discussion of epilimnetic stratification.)

The discharge will enter Lake Erie waters in Zone #06.030 ("New York to Ohio State line. All waters beyond 200 yards from shore...."). Temperature criteria for that zone are contained in Pennsylvania Water Quality Criteria (Title 25, Rules & Regulations Part One) which list criteria which "shall be considered by the department (of Environmental Resources) in its regulation of discharges." (Pp 93.1) The temperature criteria for zone 06.030 is given as follows: "not more than a 5^{o}F rise above natural temperature or a maximum of 58^{o}F." From the tabulations shown in Appendix B, it can be concluded that the water temperature at the surface of the lake under normal conditions (lake surface not frozen) will not rise more than 2^{o}F over the natural lake temperature that existed before the addition of the heated effluent. In any event the effluent shall not be "inimical or harmful to the water uses to be protected or to human, animal, or aquatic life." (Pp 93.4) The Commonwealth of Pennsylvania DER issued their Industrial Waste Permit No. 2572205 which covers the plant discharge to Lake Erie.

3.2.2.1.3 Impact on Biochemical Oxygen Demand (BOD)

The BOD of water is due to the oxygen requirement for microbial action on organic materials in the water. Microbial activity increases with an increase in temperature. The impact of the

thermal effluent will be to locally increase the rate of oxygen consumption due to microbial activity in the region of thermal discharge. Temperatures at the diffuser heads will rarely approach the range of maximum microbial activity (86°to 99°F). The dilution factor and limited temperature increase will ensure that any increase in BOD will be small, and will be within a limited area.

The thermal effluent will probably have no measurable impact on BOD. Where pH, turbidity, and BOD were measured periodically for a California thermal power plant, none of these factors changed due to thermal discharge (Reference 3.2-11).

3.2.2.1.4 Impact on Chemical Oxygen Demand (COD)

The COD, or measure of materials susceptible to chemical oxidation in water, will not be directly affected by the temperature changes expected. An increase of COD could result indirectly from oxidation of materials naturally present, with or without the power plant, in the bottom sediments if these sediments are disturbed.

3.2.2.1.5 Impact on Dissolved Oxygen (DO)

No other factors considered, saturation levels of oxygen in water decrease with a temperature rise. However, the cooling towers will allow a large water surface area to be exposed to air, thus increasing DO values where intake waters are low in DO, and decreasing values where intake waters are supersaturated (Reference 3.2-12). These changes apparently will be insignificant compared to naturally occurring changes in DO. This evidence indicates that any impact of the thermal effluent on dissolved oxygen will be negligible.

3.2.2.1.6 Impact on Bottom Communities

Studies done on thermal influence on benthic (bottom-dwelling) organisms show varied results. Where a power plant discharging to a creek was investigated, populations of aquatic worms (Oligocheata), mayflies (Heptageniidae and Hexagenia), midges (Chironomidae), clams, and sponges showed no significant differences above and below the discharge (Reference 3.2-13). However, other investigators, (Reference 3.2-11), found that the number of organisms increased with the discharge area only, and that there, warm water forms predominated over cold water forms.

More widespread effects are not felt by the aquatic community because the warm water mixes rapidly with the receiving water, and tends to remain on the surface (Reference 3.2-11). Wave action and currents rapidly cool the effluent. This would apply to thermal water discharged by the proposed plant. In addition, benthic invertebrates can become acclimated to a gradual temperature change (Reference 3.2-14).

The proposed plant's discharge diffuser will allow rapid dilution of the warm water as it rises to the surface. Benthic organisms will not be affected directly by the effluent during the greater part of the year because the effluent plumes will be vertical, the temperature rise not occurring at the lake bottom. During periods of ice cover the effluent plumes will be less regular, and currents due to wind will be reduced. If a bottom temperature rise of some duration occurs with these conditions, warm water benthic forms would compete successfully with cold water forms in the immediate discharge vicinity.

Those benthic invertebrates described in Section 2 might be expected at the power plant site. The conditions at the site are probably suitable for species found on rock bottom. Species expected include both pollution tolerant and pollution sensitive groups. Groups that might be expected at a depth of 20 feet include Tubificidae, Plecoptera, Chironomidae, Menatoda, and Sphaeriidae.

Pontoporeia affinis and Hyalella azteca are two species of scuds also expected in deeper water. Pontoporeia, a cold water form, could be affected by thermal discharge. This species is found also west of the site and would not be restricted only to the site area (Reference 2-3). These scuds are food sources for several fish species, notably lake trout (Salvelinus namaycush), and whitefish (Coregonus clupeaformis), which also feed on chironomids (Carlander, 1969).

3.2.2.1.7 Impact on Fish

Fish species, see Section 2, have a preferred temperature, or temperatures favorable for survival, which may vary with individuals according to factors including weight, size, and age. Fishes become acclimated to gradual temperature changes within limits. When these limits are exceeded, the high temperatures may be lethal in time. Aquatic organisms can become acclimated to temperature rises in a short time compared to acclimation time for a drop in temperature (Reference 3.2-14 and 3.2-15). This acclimation to temperature change occurs in natural conditions, and may vary with seasons. Fish populations acclimated to winter light conditions are less affected by a temperature drop than populations acclimated to summer light conditions.

If able, fishes move to areas of preferred temperature, avoiding temperatures too high or low. They are attracted to thermal discharge areas when temperatures there are preferred over surrounding temperatures. At a Kentucky power plant, winter populations of fish were consistently greater at the thermal discharge than above and below it (Reference 3.2-13).

Such winter aggregations have improved sport fishing at several sites. Such reactions, observed in laboratory and field, were considered in recommending preferred temperature ranges for fish species in various stages of development (Reference 3.2-1).

Of particular interest to this power plant site are the species of Lake Erie game fishes, especially walleye, small-mouth bass, and the salmonids which are periodically present in the shore area. Studies done on a power plant on Columbia River, a unique, cool river, provided no evidence of adverse heat effects on salmonid populations (Reference 3.2-16).

Any impact of temperature increase alone could include possible increase in biological productivity, affecting the aquatic food chain. Temperatures will rarely approach maximum temperatures tolerated by the fishes present in the area, excluding species present only seasonally (References 3.1-1 and 3.2-22). Maximum temperature at the diffuser heads will occur most probably during the late summer. Salmonids would be present in the area in greatest numbers only in April, October and November. If maximum temperatures should exceed preferred temperatures of some species, these fishes would avoid the zone where this occurs. Fish mortality due to asphyxiation is not expected.

Successful salmonid reproduction in Elk Creek is currently very small. Any salmonid migrations in Elk Creek would normally occur in spring and fall when surface water temperatures are well below 70°F. The recommended preferred temperature for salmonid migration is 68°F (Reference 3.1-1). During unfavorable conditions, assuming strong shoreline currents and no heat diffusion from surface water as it travels northeastward from the discharge, the fall and spring temperatures will not exceed this preferred temperature. Therefore, salmonid migration will not be expected to be thermally blocked.

A large portion of the Pennsylvania shoreline is used by fishes listed in Tables 2-5 and 6 for spawning. The area of temperature rise will be limited to the diffusion area, compared to total shallow area of the lake which can be utilized for spawning. For this reason, reproduction of fishes which utilize the shallows for spawning should not be significantly affected.

3.2.2.1.8 Impact on Water Fowl

Water fowl hunting in Northwestern Pennsylvania is reported to be good, especially for black duck, mallard, and wood duck. Water fowl which are most numerous on Erie Bay include lesser

scaup, mallard, wood duck, and teal, plus several diving species (Reference 3.2-23). The species present in the Lake Erie area utilize marsh and pond areas for breeding. (Reference 3.2-24). The thermal effluent from the proposed plant is not expected to harm these species in any way.

3.2.2.1.9 Impact of Entrainment of Organisms in Cooling Systems

Organisms entrained in cooling water in general are subjected to a rapid temperature rise, pressure changes, possible mechanical injury, and chemicals used for control of fouling and corrosion. Any impact of the process on plankton populations is determined in part by temperature change, length of exposure to high temperatures, and volume of water used in cooling in relation to lake volume. Exposure to entrainment conditions may be for a few minutes in a once-through cooling system or for an indefinite period in a closed-loop system.

The proposed plant will have a cooling-water condenser temperature rise of about 20° F. Entrained zooplankton, phytoplankton, and fish will be killed in the closed-loop cooling system due to exposure to the temperature rise an indefinite number of times.

Using figures from Tables 2-1, 2-2, 2-3, and 2-4, the maximum number of phytoplankters that might be expected to be entrained would be 85,200 per cubic foot, and the maximum number of zooplankters would be 10,500 per cubic foot, assuming that the maximum numbers would be found at the lake bottom.

The possibility of fish entrainment will be increased at seasons when fish are attracted to the thermal discharge. However, the bar screens and very low intake velocity (0.5 fps) will allow larger fish to avoid entrainment. The physical distance separating the inlet structure from the outfall structure should keep this problem to a minimum if it occurs from the effect at all.

The water velocity through the intake screens is smaller than the velocities of intakes existing in the Lake which vary between 0.6 and 2 fps. The use of 1 to 2 fps approach velocities (1.5 to 3 fps across screens) has resulted in essentially trouble free operation. Only an infrequent shad or alewife run has reportedly caused temporary screen obstruction.

3.2.2.1.10 Impact of Plant Shutdown

Plant shutdown is expected to have no adverse effect on the

aquatic community. The temperature rise of the lake will be fairly constant 2°F. Temperature of the effluent will not fluctuate rapidly in event of plant shutdown due to the storage capacity of the cooling tower basin which will continue to discharge even after shutdown and result in a gradual temperature decrease rather than an abrupt one.

Although the plant effluent temperature at the discharge point is greater than 2° F above ambient lake temperature, it is being dispersed through jet diffuser nozzels which result in a high velocity dilution to 2°F above ambient lake temperature. This effluent dilution field between the discharge point and 2° F boundary is at such a high velocity that it will preclude the presence of fish. Therefore, it is highly unlikely that fish would be exposed to a temperature greater than 2° above ambient lake temperature.

Fishes are more sensitive to sudden temperature drops than to rises. However, a sudden temperature drop of 2°F would not cause mortality, and would not adversely affect Lake Erie fish populations.

3.2.2.1.11 Impact of Cooling Water Intake

Lake Erie will supply the make-up water requirements for the Lake City Plant. The intake system will be located 1200 feet from the lake shoreline in the immediate location of the outfall diffuser pipe, with its upmost point at elevation 556 ft- 7 in., 12 feet below lake's low water level. The make-up water requirements for the 250 MW combined cycle unit under different degrees of concentration by the cooling towers will vary according to the following table:

Plant Requirements	Cooling Tower Concentrations		
	2	3	4
Make-up flow in gpm	3300	2600	2367

The vertical approach or face velocity at the inlet opening for the maximum flow of 3300 gpm will be 0.37 fps; the horizontal approach velocity is nil. Even though the intake structure will be close to the location of the outlet diffuser, no recirculation of diluted effluent will be expected because:

a. The inlet opening will be located well below the upper stratified hot water layer.

b. A maximum temperature difference of 2°F and upper stratification will be possible only 20 percent of the time (no stratification will be possible 80 percent of the time).

c. When considering the direction of predominant lake water

currents at the shoreline, the inlet opening will be located "upstream" of the outlet diffuser.

Therefore, considering the low flow requirements and the low face velocities to be used for design of the inlet opening, no alteration of the flow patterns in the immediate vicinity of the intake structure will be expected.

3.2.2.2 Protective Measures

Blowdown water from the circulating water system will flow to the lake bottom diffuser nozzles under gravity head only. There will be no mechanical components that can fail and suddenly stop the flow. Normal stoppage of the flow will be controlled by manual operation of a valve. The manual operation will be programmed to slow the discharge flow at a rate that will limit any possible thermal shock and be conducive to reacclimation of the affected fishes to colder temperatures.

To allow installation of additional multiport diffuser pipe if dictated by future operating conditions or new regulatory requirements due to environmental changes, the end of the submerged diffuser pipe will be provided with:

a. A removable plug which will be furnished with lifting eyes.

b. An extended trench beyond the end of the outfall terminus for a minimum length of 20 ft. The trench will be backfilled with excavated material.

Riprap will be placed on top of the discharge pipe to protect the pipe against wave forces and erosion effects in the shallow waters. In the diffuser area, the bottom of the pipe installation will be protected and stabilized with tremie concrete.

The intake piping installation will be provided with the same protection as the discharge piping by installation in a common covered trench. The withdrawal process at the intake can be altered by entry of sand, formation of anchor and frazil ice, and screen blockage.

To avoid the inconveniences associated with sand and silt up-

take, the intake structure will be provided with a transition zone, where the water velocity in the intake piping will increase to a self-cleansing velocity of more than 3 fps. To minimize uptake of sand, silt, and sediments, the inlet opening will be 48 in. above the lake bottom.

The screen intake will be designed for easy removal by a diver if it becomes clogged by sheet ice jams, floating objects, sediments, dead vegetation, etc.

Screen blockage by fish schools will be unlikely because of the nature of the intake structure and the designed low intake velocity.

The employment of a combined cycle plant concept and the additions of a cooling tower and diffuser will constitute the most significant protective measure the applicant has taken to minimize the impact on Lake Erie waters.

ASTM No. 2 fuel oil will be used in this plant and the fuel oil will be stored in two 48 feet high by 150 feet diameter tanks located in the tank farm. These tanks will be constructed in accordance with appropriate API Standards and each tank will be equipped with a foam fire extinguishing system.

Each fuel tank will be enclosed within the perimeter of a six foot dike. The area of the dikes will be sized to provide 2 feet of free board in the event the storage tank ruptured. Both the dike walls and their enclosed area will be constructed to be free of leakage.

3.2.3 Noise

The entire plant is subject to the provisions of paragraph 406.3 of the Girard Township Zoning Ordinance adopted October 1, 1965 which prescribes maximum noise level output from a property between the hours of 10:00 P.M. and 7:00 A.M. The ordinance however, is specified in terms of octave bands of frequency as specified in American Standards Association standard 24.10-1953 whereas common practice at this time makes use of those octave bands of frequency described in ANSI S1.6-1960. By making use of a method outlined in Appendix A of ANSI S1.11-1966, the specified ordinance levels may be adjusted to be compatible with existing data on plant components.

These adjusted ordinance criteria are shown below along with the expected noise levels of the entire plant installation which would be measured at the two most critical positions around the plant.

Octave Band Number	1	2	3	4	5	6	7	8
O. B. Carter Freq.	63	125	250	500	1000	2000	4000	8000
Girard Twnshp Ord. (adj.)	65.5	52.3	45.6	40.0	36.3	33.3	30.3	27.3
Plant at property boundary	62	52	43	39	35	31	26	23
Plant at closest neighbor	54	44	34	29	24	18	10	6

The plant property boundary in question is at the edge of Pennsylvania Highway Route 5 near the existing entrance driveway. The nearest neighbor considered as being acoustically critical is the residence situated at the south side of the PRR tracks almost directly southeast of the plant site. (Referring to Figure 3-1, the expected levels at this neighbor's house fall mostly below the existing normal ambient. On occasion it will lie almost entirely above, when the ambient falls off for certain cases as has been measured by Goodfriend. However, the figure shows that at no time will the noise violate the Girard Township Ordinance.)

No data need be presented for the noise at the lake shore marina site to the east of the plant. Primarily due to the high bluff on which the plant rests, the estimated plant noise would be merely audible outside these residences and probably not at all audible inside.

3.2.3.1 Protective Measures

Most of the noise producing components in this station will be located within the confines of the main building and the maximum predicted noise level inside the plant can be as high as 99 Dba during full load at a position adjacent to the combustion turbine. However, as the observer moves away from these noise generating sources, the ambient noise level will drop.

In order to keep the ambient plant surrounding noise at a low level in the Lake City Plant, the following protective measures will be employed. This will include housing many of these components inside the local enclosures to keep the noise from spreading. All the major noise producing components will be located inside a metal frame building. To make this building even more effective, a two inch thick layer of fiberglass insulation will be installed on the inside wall.

Since the plant will be located approximately 2400 and 2000 feet away from Elk Creek and Pennsylvania Route 5 respectively and since sound level decreases with an increase in distance, this will further ensure that the noise level at the property boundary line will be low.

The plant components are specified to conform to predetermined noise levels such that the entire plant conforms to the Girard Township noise ordinance cited above. The effect of the compliance at the property boundary is to provide acceptable levels at nearby residences for all operating conditions. In the event that actual installation of either the main plant or the cooling tower do not comply with their guarantees and contribute to violations of the ordinance, several avenues of correction are available. The cooling tower fan speed may be supplied with a variable speed capability permitting marked reduction in noise emission. This capability would ordinarily then only be used during the effective hours of the ordinance due to a slight performance penalty imposed on the plant. The gas turbine inlets, although equipped with "maximum" silencing on installation could be further modified for noise suppression, but not without great cost. The combustion turbine exhaust from the waste heat boilers could also be subjected to further attenuation, but not without performance losses or, again, great costs.

The technology is available also, in the unlikely event that the foregoing has not yet brought about compliance, to further treat the cooling towers with noise absorption materials, but since this would be the most expensive of all corrective procedures considered, such a step would be taken last.

All such procedures are considered only as planned solutions to potential problems. It is expected that manufacturer guarantees will permit compliance with the existing noise ordinance.

3.2.4 Aesthetics

3.2.4.1 Estimated Impact

The skyline at the plant site will be altered by the erection of the main plant building and the supporting structures. Most of these structures will have low silhouettes as shown in the pictoral illustration. The highest structure presently known will be the exhaust stacks on the main building, which will be 85 feet high. The only other structure which may equal or exceed the 85 ft height will be a water storage tank whose requirements are presently undefined.

All the above structures will affect the homogeneity of the site; but this disturbance will be minimized because of the limited size and height of these structures, and the fact that this area is wooded so that in the summer months, most of the structures will be shielded from view by the foliage. From the lake, the structures cannot be completely viewed within 3/4 mile of the shore, because of the approximately 80 feet high bank. Close to shore boaters will only be able to see the upper portions of the structures.

3.2.4.2 Protective Measures

Much has been done to mitigate the aesthetic impact of the combined cycle plant through low-profile design of all the plant's related structures.

3.2.5 Climate

3.2.5.1 Estimated Impact

Due to the relative small size of the cooling tower and its proposed location, no important environmental effects from the plume are anticipated as far as the highway, Elk Creek Marina, or other activities off the property are concerned. A study by Dr. Charles Hosler, Dean of the College of Mineral Sciences, Pennsylvania State University, and consulting meteorologist, predicted that condensate plume from the cooling tower will exist, but it should not persist for more than 600 feet from the tower whereas the nearest distance between the tower and Lake Road is about 2300 feet and 2400 feet from Elk Creek Marina.

3.2.6 Land Use, Recreation, and Historic Sites

3.2.6.1 Estimated Impact

The adjacent land to the Lake City Station is very sparsely settled. Most of the land north of Pennsylvania Route 5 along the lake front is wooded and the land located south of Pennsylvania Route 5 is presently being farmed.

The proposed plant will be located approximately 2000 feet north of Pennsylvania Route 5 on a property owned by Pennsylvania Electric Company. This plant is designed to be operated and maintained by a crew of 3 to 5 persons during normal conditions. In the event of a major repair, a crew of up to 35 persons can be expected; and, therefore, the traffic pattern will be slightly altered. Other than these, there are no major permanent alterations anticipated.

There are no recreational facilities or historical sites located on the proposed site of this plant; however, there are recreational facilities that are located nearby. These facilities include Lake City Trailer Court, Lake Erie County Park, and Elk Creek Marina. There is an authorized Federal project for a small boat harbor also. In addition, the Tri-County Archery Club is presently using a small parcel of this site owned by Pennsylvania Electric Company as an archery range.

The nearest hunting areas are State Game Land No. 101 in southwestern Erie County, and Farm Game Project No. 73 at North Springfield southwest of the site. The 1970 deer

hunting harvest of 699 deer indicates that hunting pressure for large game is not as intense in Erie County as it is in surrounding counties (Reference 3.2-23).

Both Lake Erie and Elk Creek are utilized for fishing in the site vicinity.

Only one item that could possibly be considered as a historical site would be an old state line marker which formerly separated Pennsylvania from New York. This marker is located approximately 4 to 5 miles away from Elk Creek.

3.2.6.2 Protective Measures

The impact of the proposed plant will be to exclude the plant site from public access and from use for any recreational activities. The plant should therefore have minimal impact on hunting, fishing, and boating in the area. The plant will have no impact on historical sites.

3.2.7 Potential Operational Difficulties

3.2.7.1 Types

Potential difficulties due to operation of the combined cycle plant would occur generally in the following equipment or systems:

a. Mechanical draft cooling tower

b. Sanitary waste systems

c. Mechanical waste water treatment system

d. Fuel storage tanks

e. Electrical generators

f. Transformers

g. Gas turbines

h. Steam generators

3.2.7.2 Protective Measures

All the systems within the plant were designed to operate satisfactorily over a wide range of operating conditions, and these systems will be functionally tested before they are placed into commercial operation.

In addition, system monitoring devices will be located throughout the plant to aid the operators in routine operation of the plant and to alert the operator if any system is not operating normally.

The multi-cell mechanical draft cooling tower would continue to function satisfactorily in the event of breakdown of one fan or it's driving motor. There would be a slight increase in the operating condenser backpressure and in the blowdown temperature. The latter conditions could be reasonably expected to fall within the calculated range of the diffuser and should have no impact in the lake. Due to the large water quantity stored in the system, temperature changes will be slow in developing. In the unlikely event of the increased blowdown temperature being a problem, corrective action could be taken by load reduction on the steam turbine generator.

If there is a breakdown of one of the operating pairs of circulating water pumps, there will be an increase in condenser backpressure, and an elevation of cooling tower blowdown temperature. Should the latter be outside calculated limits it can be corrected by load reduction on the steam turbine generator. Should both circulating water pumps break down there would be an immediate load rejection on the steam turbine generator with no influence on blowdown temperature. The steam generator safety valves would probably lift and release steam to the atmosphere for a short period of time. This occurrence should not have any adverse effect on the environment.

All sanitary waste will be collected into the septic tank and drained through a tile field. If the septic tank becomes full and backs up into the sanitary system, the problem can be alleviated by pumping out the septic tank for offsite disposal. (See Appendix C for description of sanitary system.)

Breakdown of the mechanical waste water treatment plant is limited to sump pumps, pH control valves, mechanical oil skimmers, and mechanical clarification. Provision has been made for duplicate sump pumps and pH control valves to provide continuous treatment of wastes. Failure of a duplicate pump will require the use of portable sump pumps that will be made available. The pH of the waste will be controlled at various points with separate systems. Roughing pH control systems will be incorporated into the boiler sumps and the neutralizing tank. The final pH control adjustment tank will also serve as a backup system in the event of a roughing pH control system failure.

A breakdown of the mechanical oil removal system would result in a carryover of oil into the retention pond where a baffle will prevent oil from escaping to the lake. Oil and scum would then be removed manually.

A breakdown of the mechanical clarification unit would permit solids to settle out and remain in the bottom of the clarifier. If solids should carry over the top of the clarifier, they would settle out in the retention pond.

Cooling tower operation difficulties may result in changes in the chemical composite of the blowdown. However, these changes would not be significant and the blowdown water could still be safely released direct to the lake.

All plumbing, tanks, and pumps will be sized to handle the maximum peak flow to prevent backups and flushing out of tanks.

Rupture of a fuel storage tank is possible, therefore, the fuel storage tanks will be surrounded by two 6 ft high earthen dikes. Each dike contains one 48 x 150 ft tank. The area surrounded by each dike will be sized so that if the tank failed, the available storage volume would be sufficient to hold all of the fuel oil within the dike with at least two feet of freeboard remaining to protect the integrity of the top of the dike. The entire diked in area will be constructed with impervious materials to prevent seepage into ground water supplies.

The diked area will be sized so that the contained volume is sufficient for the ultimate installation of two additional 48 x 150 ft tanks if they are needed in the future.

Both tank truck and railroad tank car fuel unloading systems will be provided for this station. The actual number of unloading stations will be specified at a later date. The construction of these stations will consist of dry disconnect couplings mated to flexible hose and connected to metallic piping. All the unloading stations will be piped to the suction side of the fuel oil transfer pumps so that the unloading fuel oil can be pumped to the desired storage tank. The unloading facility will be designed to unload up to 6.24×10^5 gallons of fuel oil per eight hour shift period.

The chance of an oil tank fire at this station should be slight but nevertheless the possibility does exist. In case of such a fire, dense blue smoke will result and will cause air pollution. However, the following design features will be incorporated into the fuel storage system to minimize such an occurrence: all fuel storage tanks will have a floating roof, and a mechanical foam fire extinguishing system located within the tanks. All the fuel tanks will be located within a six foot earth dike and fire hydrants will be located adjacent to the storage area.

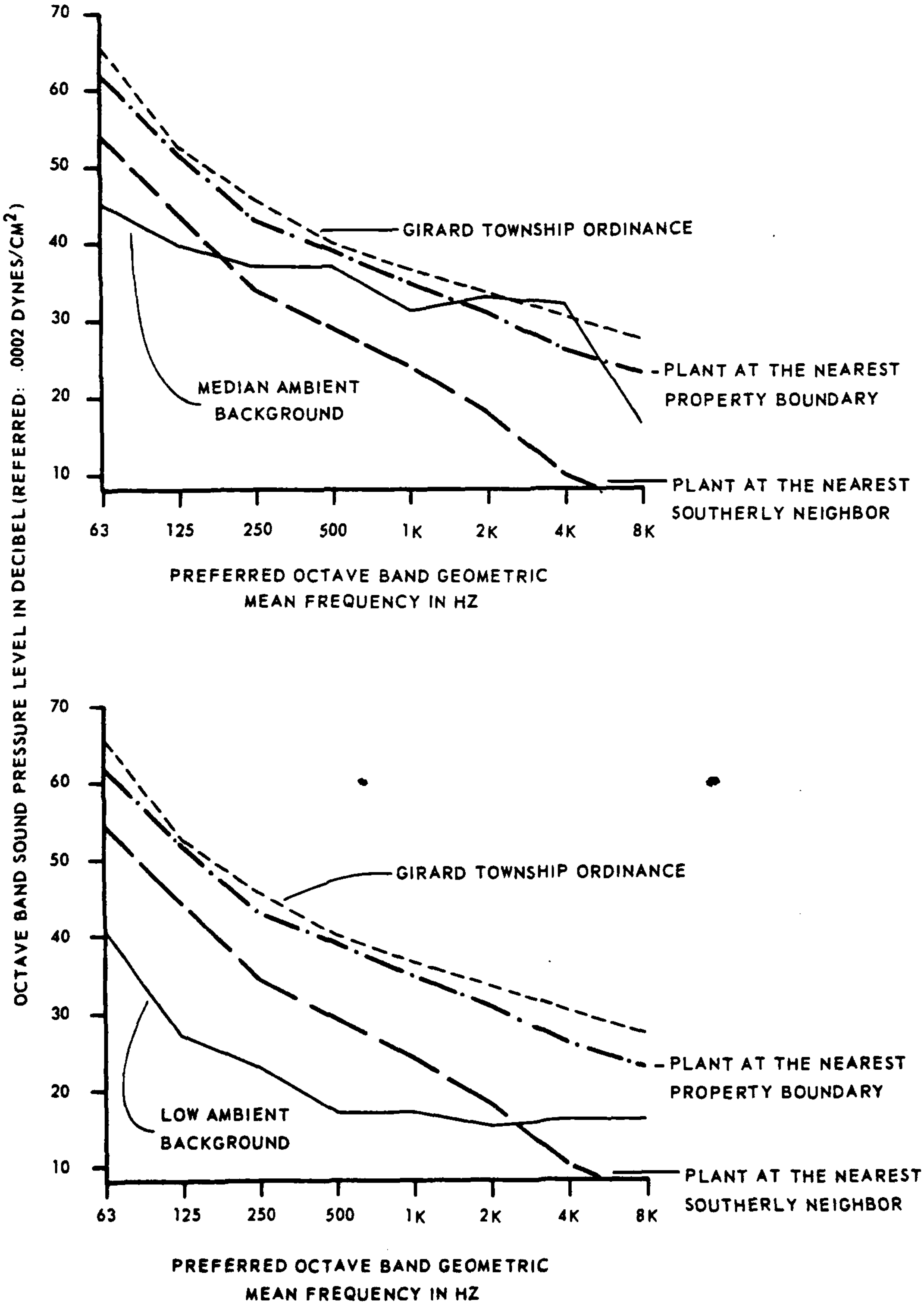
Accidental oil spills at the oil unloading stations will be contained by a below surface collection system and drained

by gravity to a sump from which they can be pumped to within the main tank dikes for disposal along with other waste oils.

Combustion turbines and generators in the plant will be protected by individual Halon fire extinguishing systems, supplemented by an in-plant water extinguishing system, outdoor fire hydrants, and deluge spray systems on the station. A standby source of water will be available at all times in the form of an elevated water tower and this will be supplemented by water fire pumps.

A leakage of transformer oil will be trapped in a stone filled concrete pit beneath the transformer. Should the water or oil level in the pit rise above a fixed point, the liquid will be automatically drained away to another large holding tank from which the oil will be periodically removed and disposed of in a routine acceptable manner, such as incineration or transported to an oil reclamation facility.

PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



ESTIMATED CONTINUOUS NOISE OUTPUT
FIGURE 3-1

REFERENCES-SECTION 3.1 AND 3.2

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4.0 PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED SHOULD THE PROPOSAL BE IMPLEMENTED

Technology has not yet developed to the extent that "zero emissions" are a reality, but these emissions are severely restricted in order to minimize their impact as discussed in Section 3. However, the mere fact that there are emissions and that the need to prepare the site for construction is an unavoidable necessity, these controlled effects must be considered as adverse environmental effects and are listed below. The fact that state and federal standards are not exceeded means that the impact will not be worse than that recognized in establishing the standards.

4.1 CONSTRUCTION PHASE

Release of combustion products and noise production from construction equipment.

Removal of wooded areas and vegetation will result in an increase in surface runoff time as well as a disturbance to indigenous wildlife on the site. As discussed in Section 3.1.2, sediment control facilities will be used to control the sediment load entering Lake Erie.

Dredging and blasting during the construction of the intake and discharge structures.

4.2 OPERATION PHASE

Release of limited amounts of SO_2, NO_x, particulates, and smoke from the combustion equipment.

Discharge of thermal effluent from cooling equipment into Lake Erie. Continous production of noise from normal plant operation. Limited entrainment of aquatic organisms in the cooling system. Loss of a small volume of lake water by evaporation in the cooling tower.

5.0 ALTERNATES TO THE PROPOSED ACTION

5.1 CURRENT AND FEASIBLE

5.1.1 Other Generation Methods

Because of the varying customer demands for electric power on daily, weekly, and seasonal cycles, there is opportunity to use to advantage various types of generating capacity in meeting these customer requirements.

A certain portion of the electric demand (40-50 percent) is continuous, and to supply this type of service, including additional pumping load for pumped storage plants, GPU needs to have 50-60 percent of its installed capacity in the form of base-load units. Generally, these units will have a relatively high installed cost which, however, is justified by their ability to operate and produce energy at a relatively low cost (including cost of fuel consumed). Nuclear units, mine-mouth coal-fired units, other very efficient fossil-fired units, and certain hydro plants would be suitable for this type of operation.

For electric demands that exist for only a portion of the time, represented by the heavy load periods of the day (i.e. in the neighborhood of 4,000 hours per year), the cost of producing energy is somewhat less important than it is for the base portion of the load, and a different type of unit can be justified. Often these will be the older units on a system, that were once used for base operation; but they may also be units specially designed for this type of service. These latter might be combined cycle units, such as is proposed for installation at Lake City, or oil-fired cycling units. The higher energy cost for such units, which is the result of higher fuel costs or lesser efficiency, is compensated for by lower installed cost.

For that portion of the electric demands that exist only over peak periods (for less than 2,000 hours per year), there are now a variety of suitable generating sources. These are characterized by low installed costs and generally high energy costs. Peak portions of the load in the GPU System are supplied by older and inefficient steam generation, by several small hydro plants, by pumped storage, and by combustion turbines.

Because of these differences in cost characteristics (as well as physical capability in the case of hydro or pumped storage), not all of the capacity that might be installed by a utility system can be of the same kind. The GPU System has planned its capacity additions with the intent of achieving a reasonable balance among the various types, as shown by Figure 5-1.

The optimum balance is, of course, subject to change with changes in cost of construction or changes in fuel price; and the extent to which a balance is achieved will depend on the approval of planned additions.

The proposed Lake City combined cycle unit is an intermediate type, designed for operation for approximately 4,000 hours per year. Assuming there is a need for such capacity in GPU, as indicated above, it is economically undesirable that it be replaced with either peaking or base capacity. This is illustrated in Figure 5-2, which shows the estimated total cost per kw per year for several types of installations as a function of their hours of operation. The lower cost of the combined cycle unit in the mid-range of operation is evident.

This comparison has been made entirely on a cost basis and without regard to other pertinent considerations.

The only type of capacity that could now be installed in 1974 to replace the Lake City combined cycle unit would be combustion turbines; this is a too high percentage for overall economy, since some of these units are then called upon for long hours of operation (or as an equivalent to actual operation, are used as the basis of price for interchange purchased by GPU). Figure 5-2 shows that, above 3400 hours per year, the combined cycle units are more economical to operate than combustion turbines. Should fuel prices continue their recent upward trend the better fuel efficiency of the combined cycle relative to simple cycle combustion turbines will make it more economical at a lesser number of hours per year and perhaps a substantially lesser number.

The only other type of peaking capacity now planned by the GPU System is hydro pumped storage. This could not be considered (apart from economics) as an alternative to the proposed Lake City unit because of the long lead times required in the planning, approval, and construction of such capacity and the natural limitations on the hours that such capacity can be operated.

The comparison in Figure 5-2 has been made with nuclear generation as an example of base capacity. Nuclear generation is, in fact, the most economical base capacity which utilities can now plan to install in the eastern portion of PJM. However, in the PENELEC area further coal-fired capacity is planned for development, but only at mine-mouth locations. Oil-fired steam capacity will for cost reasons most likely be limited to intermediate operation. Furthermore, use of oil increases the dependence of essential utility services on an imported fuel. This dependence should be limited as much as possible by nuclear and coal-fired installations. GPU, therefore, is committed to and is planning for as much nuclear and mine-

mouth capacity as possible to meet its base requirements; but limitation of time and financing capability preclude the substitution of such capacity for the proposed Lake City installation.

The only feasible alternative at the Lake City site would have been an oil-fired boiler and steam driven turbine-generator. Such units have been designed for intermediate operation and are referred to as oil-cycling units. Oil-cycling units and combined cycle units are directly competitive in their ability to provide an intermediate type of service. Both types of units are being installed and planned in PJM, and GPU now has oil-cycling units as well as combined cycle units among its planned generating capacity additions. Considering construction costs, fuel economy, expected reliability, and operation and maintenance costs, there is a close balance between these competing types in their economic desirability; and until several combined cycle units have operated long enough to ensure their satisfactory performance, it will remain difficult to choose between these types entirely on an economic basis.

There are, nevertheless, good reasons for PENELEC's choice of the combined cycle unit for its proposed installation at Lake City; these are:

a. The combined cycle unit will consumptively use about half the water required by an oil-cycling unit of the same capacity.

b. The combined cycle unit uses its fuel more efficiently and generally uses a higher quality fuel (hence efficiency is offset by higher fuel cost); thus there is less discharge of pollutants to the atmosphere.

c. The oil-cycling unit could not have been planned, ordered, and constructed in time to provide capacity in 1974.

While these are good reasons for the choice of the Lake City installation, they are not decisive in other locations.

5.1.2 Other Sites

Because of the need for generation in PENELEC and particularly in its Northwestern Division near Erie, Pennsylvania, and because time limitations made the acquisition of new sites difficult, if not impossible, only two alternative sites were considered.

One alternative was in another power-deficient area of PENELEC, this being the eastern portion of its Northerntier Division (yellow area on map, Figure 1-1, centered around Towanda, Pennsylvania). The only generation presently operating in

this area is a single combustion turbine at Blossburg and two diesel engines at Benton, or a total of about 27 MW (the small hydro plant at Oakland is out of service). A site for a future nuclear plant is owned by PENELEC; this is on the Susquehanna River near Mehoopany. This site would be suitable for a combined cycle installation, and the capacity of the proposed unit was comparable to the area power requirements.

The other site with which economic comparisons were made was at the Gilbert Plant on the New Jersey side of the Delaware River, where another combined cycle unit will soon be under construction. The combustion turbine portion of this plant at Gilbert is expected to be in service in 1973 and the steam portion in 1974. The extension of the combined cycle installation to include a second unit (that now proposed for Lake City) would have had certain advantages. However, because other GPU generating capacity is planned for early installation in New Jersey, there is not an immediate need for this additional capacity at Gilbert, as contrasted to the demonstrated need near Erie. This New Jersey capacity includes two 400 MW oil fired cycling units at Union Beach scheduled for installation between 1976 and 1979, and a 1200 MW nuclear unit at Forked River in 1978. Other capacity will be needed following these planned installations, but is not needed prior thereto in New Jersey.

No alternative sites were considered in the Erie area, although other suitable locations could probably be found along the lake shore, east or west of the city. Because PENELEC owned a large site near Lake City, which is advantageously located with respect to transmission, other lake shore locations appeared to have no economic or environmental advantage. No consideration was given to the expansion of the existing PENELEC plant at Front Street within the city of Erie, because of space limitations.

PENELEC owns other developed and undeveloped sites at which additional generating capacity could be installed. None are in the Erie area, where generation is presently needed; and some are being reserved for future coal-fired installations.

As between the Lake City and Susquehanna River site, there was a small economic advantage for Lake City. This resulted from its lower capital requirements for transmission and for oil delivery facilities compared with the Susquehanna site.

Detailed environmental comparisons of these sites were not made, because of generally similar but minimum effects of the proposed plant on the environment. At both sites it was planned that cooling towers be used to eliminate discharge of heat to the lake or river; and at both sites the use of a

high quality fuel would minimize discharge of pollutants to the atmosphere. On balance, however, the Lake City site would be preferred because (1) the small consumptive use of water is of less significance to Lake Erie than it may eventually be on the Susquehanna River, (2) Lake City needed no new transmission line construction, whereas, about four miles of double-circuit 230 kv line were needed for the Susquehanna site, and (3) the economic advantages of the site over the alternate sites are indirectly passed on to the consumer.

5.1.3 Environmental Comparisons of Fuel Oils

5.1.3.1 No. 6 Fuel Oil vs No. 2 Fuel Oil

Environmental effects of fuel oils are a result of combustion products emitted through the stacks. The nature of these combustion products is determined by the chemical composition of the fuel and the mechanism of combustion. No. 2 fuel oil is the cleanest commercial fuel oil available today and, in addition, is suitable for combustion turbines without pretreatment. Although No. 6 fuel oil may be used, the need for pretreatment adds capital and operating expense and thus, economically, No. 2 fuel is more advantageous. Environmentally, both fuels must meet applicable Federal and State ambient air quality and emission standards.

5.1.3.2 No. 2 Fuel Oil vs Crude Oil

These two fuels are presently an economic standoff in the Erie area and environmentally, both fuels would meet ambient air quality and emission standards. However, sources of crude oil are just developing in the Erie area.

5.1.3.3 Results

Since there is no clear cut environmental benefit between the above mentioned fuels, and since No. 6 fuel oil requires pretreatment and crude oil supplies are just being developed in the Erie area, the decision was made to use No. 2 fuel oil for the Lake City Combined Cycle Plant.

5.1.4 Other Means of Dissipating the Station Heat Load

The decision to proceed with an evaporative mechanical draft cooling tower with makeup and blowdown to Lake Erie was decided upon after consideration of the following alternatives:

a. Direct lake water cooling

b. Man-made cooling pond

c. Spray pond

d. Direct air cooling

5.1.4.1 Direct Lake Water Cooling

Direct lake cooling generally makes for a less expensive installation than a cooling tower. The cooling tower installation has a requirement for pump and fan power of two and a half to three times the pumping power requirement of a direct cooling system. However, the general grade in the Lake City Plant area is about 100 feet above the lake surface. This works to the disadvantage of the condenser circulating water system. It makes for a more expensive installation. In order to found the plant at an elevation that would allow a full syphon, earthmoving work on an enormous scale would be required. At the other extreme if the plant was founded at the top of the bluff and designed to operate on a partial syphon, additional pumping power in the amount of 2500 horsepower would be required. A direct cooling scheme does not show to advantage for this plant at this particular site. Furthermore, environmental impact considerations make the dissipation of the waste heat in a cooling tower preferable to dissipation by direct return to the lake. Any variation on the direct return such as a diffuser outfall or dilution pumping geared to reducing the temperature of the water at the lake surface would be still less economical when compared to a cooling tower, although environmentally, this would cause the same effects.

5.1.4.2 Man-Made Cooling Pond

The required 80,000 gpm circulation through the plant could be taken to and from a man-made cooling pond. The required active pond area would be about 125 acres in order to give a cold water temperature 5° or 6° above the natural. The evaporation from the pond would have to be supplied either from Lake Erie or from a local catchment area. In order to be independent of the lake an estimated 1250 acres of catchment would be required, which is far greater than the total site area. Furthermore, the high percolation rate of the soil raises concern for the adequacy of any available catchment. Should the evaporation be made up from Lake Erie there would still exist the need for 125 acres. Such a pond would be about 10 feet deep and would in all likelihood have to be lined with an impervious base. A pond so developed would be costly and yet the acreage involved is too small to make consideration of recreational amenity a factor in the cost-benefits analysis. On the other hand the pond would occupy a significantly large part of the 639 acre site. There is no justification apparent for consideration of a man-made pond over an evaporative cooling tower.

Environmentally, the major problems of cooling ponds are:

1. Destruction of a large amount of land which must be lined with an impervious material to prevent cooling water loss. This would have a detrimental effect on the long term productivity of the site.

2. Cooling ponds generate fog, just as cooling towers do; however, the fog from a cooling pond is ground fog which, on days with low wind velocity, could have an environmental impact on Pennsylvania Route 5 at Elk Creek Marina. This is not the case for the cooling tower as shown by analysis of fog dispersion from the cooling tower plume for the site. (Section 3)

5.1.4.3 Spray Pond

There is no accepted design basis for spray ponds. There are no known operating spray ponds having the thermal performance that would be required in a Lake City installation. Nonetheless, if a pond were developed in modular layout with adequate air lanes between the modules and a light water loading held, the performance could be predicted with reasonable confidence. With such conservative approach to design (0.07 gpm/sq ft referred to gross pond area) an area of 20 to 25 acres would be required for the 80,000 gpm Lake City installation. The piping and the piping support system required to distribute this flow to the modules dispersed over the 20-25 acres is quite extensive. The cost of this and the cost of the impoundment and the impervious base all assume proportions which throw the economy of this type installation into doubt when viewed against the background of an uncertain design basis. Furthermore, the usage of 20-25 acres of the site in this way is a questionable usage of land. Environmentally, the destruction of an extra 25 acres of land and the possibility of excessive ground fog precludes the use of a spray pond.

5.1.4.4 Direct Air Cooling

Since the limit of cooling is governed by the dry bulb temperature rather than the wet bulb temperature, the cold water temperature which is attainable within a reasonable economic framework in direct air cooling is generally 15°F to 25°F higher than applies for an evaporative cooling tower installation. The condensing pressure that is obtainable in the steam turbine cycle is closely related to this cold water temperature. Generally speaking, the turbines currently used are designed to operate over a range from 1 to 5 in. Hg back pressure. The consequence of this is that the 110 MW Lake City turbine would have to be custom designed for operation under the back pressure conditions (10 to 20 in. Hg) which would apply for a condenser operating with direct air cooling. The "packaged" combined cycle unit contemplated for Lake City

is not designed for and could not operate under the back pressure conditions which would apply with a dry cooling system of anything other than the most exorbitant design. The system would have an inordinate amount of extended fin surface and a tremendous fan power demand and would be priced accordingly. The essential fact is that if one had no alternative but to use a dry cooling system, the steam turbine would be procured with this in mind and would be of different design than that of the turbines furnished with "packaged" combined cycle units offered the electric utility industry at this time.

5.1.4.5 Other Schemes For Cooling the Effluent From the Plant

A man-made pond cooling the 1400 gpm blowdown from the cooling tower was considered as an alternative to a diffuser outfall. Table 5.1-1 shows average climatological data for the area which was used for the evaluation of pond performance. The equilibrium temperature of a pond would be from 5°F to 10°F higher than the lake temperature for about half the year and consequently temperature dilution of the pond outlet flow would be required to meet requirements. A six acre lake would require dilution flow at all times of year and this flow would approach 7000 GPM under the most stringent conditions (see Table 5.1-2). The dilution capacity has to be provided in the intake pumphouse, making it far larger than would otherwise be required.

The vast increase in pumphouse and lake intake costs necessitated by the need to pump four to five times the water flow otherwise required, the cost of providing an impervious bottom in a six-acre pond, and the complications of cold weather operation all serve to make the pond highly undesirable.

5.2 PRESENTLY NOT FEASIBLE

5.2.1 Possibility of Not Providing Power

Rather than provide the planned capacity for system use, it is necessary to consider the possibility of avoiding the installation either at Lake City or an alternate site. This possibility has two aspects: (1) the possibility of discouraging or limiting load growth and the need for additional generating capacity or (2) the possibility of operating with less reserve capacity and hence with less reliability and economy.

5.2.1.1 Limitation on Load Growth

So far as 1974 is concerned, the assumption of zero growth, which would obviate the need for the proposed Lake City unit, would be absurd. It must be assumed that there will be a continuation of growth trends experienced in the past. Any

other planning basis would be imprudent. The GPU operating companies have obligations under the Public Service Laws of the Commonwealth of Pennsylvania and the State of New Jersey to plan for and provide an adequate and reliable supply of electric power. Thus, load growth limitation is not a reasonable alternative.

5.2.1.2 Operation with Lower Reserves

Operation of the GPU System or of PJM with lower reserves will permit delay in the installation of new generating capacity. At the time it is placed in service (1974) the proposed Lake City installation will increase the GPU reserves by about 4 percent from 14 percent to 18 percent (exclusive of temporary purchases). The system could operate without Lake City and with a lower reserve than 20 percent; but this would have the following undesirable effects:

a. Reliability of service would be decreased and the need for voltage reductions for curtailing load would be increased. The state regulatory commissions and the FPC have urged an increase in reserves to avoid these hazards to reliable service.

b. Older and inefficient steam units would operate for longer hours and at higher loads, with consequent greater discharges of pollutants to the atmosphere and of heat to rivers or ponds. Also, combustion turbines would more frequently be called into service, with resulting inefficient use of fuel and greater discharges of exhaust gas to the atmosphere.

c. As a result of the less efficient use of fuel described in item (b), the cost of operation would be increased; and most of this increase would be directly borne by consumers through automatic operation of fuel adjustment charges. It has been estimated that operation of the Lake City combined cycle unit will reduce GPU's fuel expense by about $4,800,000 per year.

Before the decision can be made to operate with lower reserve, it would be necessary to balance these effects on reliability of service, the environment, and the cost of service against the costs (environmental and economic) of providing the planned reserve. This is a difficult evaluation, because of the largely intangible nature of some major elements such as reliability and adequacy of supply; but the informed judgment of the FPC, state regulatory bodies, and of the utilities is that a higher rather than a lower reserve is desirable.

However, if the decision were made for operation with lower reserve, it would still be necessary to determine whether this should be accomplished by deferring the proposed Lake City

installation or some other planned capacity. It is the Applicant's opinion that, under this circumstance, the Lake City unit would be favored over others.

5.2.2 Exotic Generation Methods

Various exotic sources, such as MHD, solar heat, fuel cells, wind power, must be dismissed as not feasible in the time period (to 1974) or in the area that is to be served by the proposed Lake City addition.

5.2.3 Possibility of Purchased Power

There was and is no possibility of continuing power purchase in an amount equivalent to the capacity and energy of the proposed Lake City Project. No privately owned utility in PJM or nearby areas is in a position to finance the development and long-term scale of generating resources of such magnitude to other utilities. Arrangements have been made from time to time for temporary purchases of capacity equal to the proposed Lake City capacity. For example, the GPU System expects to purchase about 400 MW for a four month period in the summer of 1975, and to purchase smaller amounts in the summers of 1973 and 1974. Recent efforts to purchase substantial amounts of capacity for a period of several years were unsuccessful.

There is no nearby public agency that has such large amounts of power for sale or can sell to utilities in Pennsylvania and New Jersey. The Power Authority of the State of New York (PASNY) is the owner of several large existing plants and of others now under construction. Except for relatively small amounts of preference power, some of which is supplied through the GPU System to Rural Electric Co-operatives (REC's) in Pennsylvania, the PASNY output is dedicated to New York use.

Hydro power from Labrador and northern Quebec has at various times been considered as a potential supply for loads in northeastern United States. The amounts available are very large and a low cost at the source may justify transmission over the long distances required for use of this power in New England or New York. Additional transmission would add to the cost. No negotiations were held by GPU with the owners of these hydro developments, for it was understood that utilities closer to the source were engaged, and may again be engaged in such negotiations. Considering the lower cost of delivery of this hydro power to New York and the greater incentive that Consolidated Edison, for example, has to utilize such a supply, it is recognized that both economic and environmental factors favor other utilities as potential purchasers of this power. At the end of July 1972 Consolidated Edison announced its agreement to purchase some of such power for a 20-year period beginning in 1977.

In any case, it is apparent that a purchase of capacity does not, of itself, create an additional generating source. Purchases are feasible and are a logical way of meeting capacity deficiencies only when an excess of generation exists in some nearby area. Under present conditions it is unlikely that other utilities will deliberately continue to finance and operate excess capacity. To meet expected demands capacity must be installed either at Lake City or some other site; and consideration of purchase (rather than some other GPU site) simply shifts the financial burden without change in the physical situation.

TABLE 5.1-1

AVERAGE CLIMATOLOGICAL DATA FOR ERIE, PA.

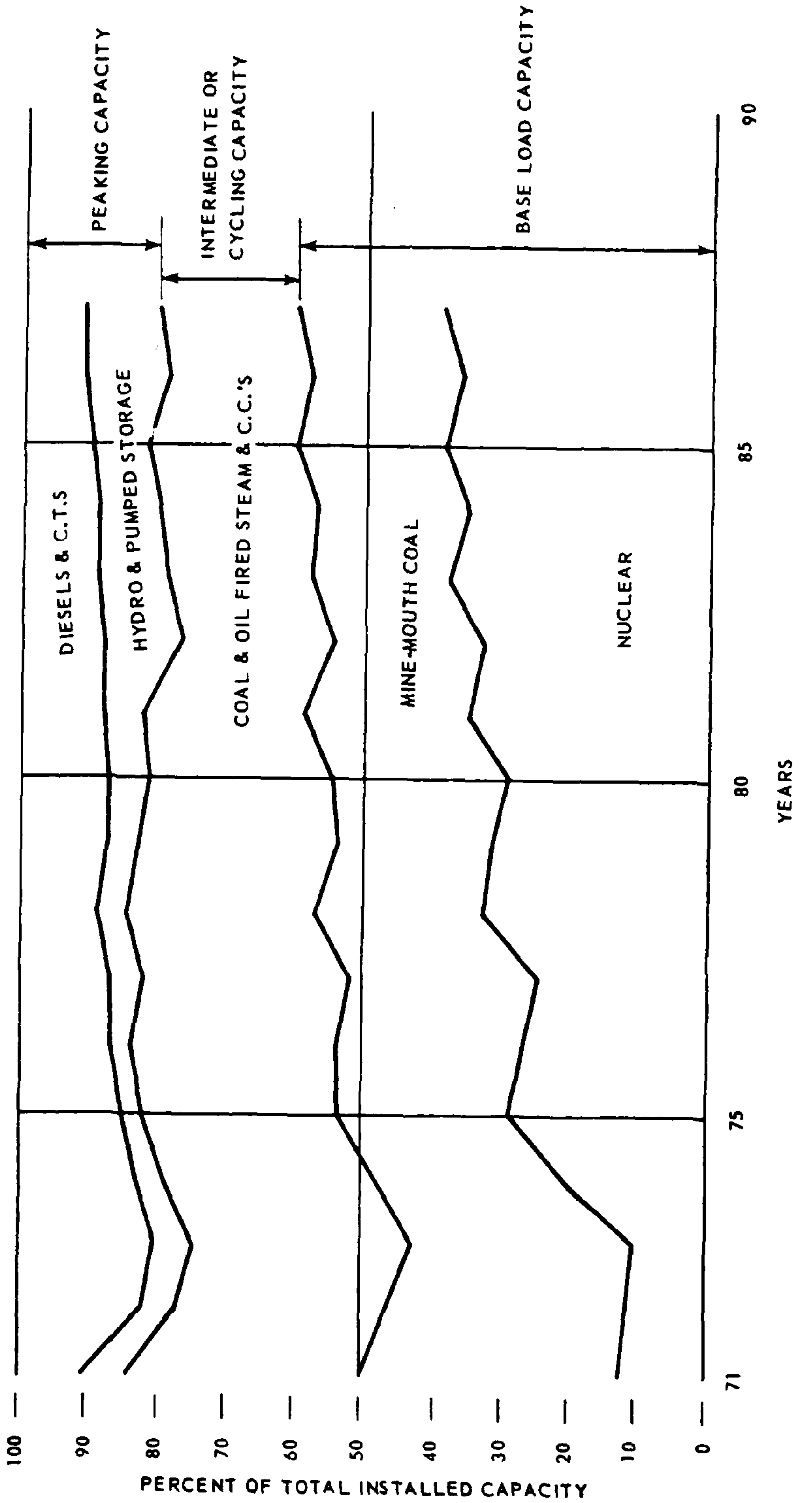
Month	Air Temperature °F	Relative Humidity	Exchange Coefficient Btu/avg/day/°F	Lake Average Water Temp. °F	Equilibrium Temperature °F	Diff. between Eq. Temp. and Lake Temp.
January	27.0	78.5	38.8×10^5	33.0	26.0	-7.0
February	26.7	76.0	39.2×10^5	33.0	28.0	-5.0
March	34.9	73.5	44.7×10^5	33.0	38.0	5.0
April	45.5	69.5	51.9×10^5	42.8	51.0	8.2
May	57.3	69.5	58.0×10^5	53.6	63.5	9.9
June	67.5	69.5	66.6×10^5	68.0	74.5	6.5
July	72.1	68.5	67.5×10^5	73.4	78.5	5.1
August	70.4	70.5	62.7×10^5	75.2	76.0	0.8
September	63.9	72.0	56.2×10^5	66.2	67.5	1.3
October	52.8	72.5	52.5×10^5	57.2	54.5	-2.7
November	40.8	74.0	44.5×10^5	44.6	39.5	-5.1
December	30.0	76.0	39.2×10^5	33.0	29.0	-4.0

TABLE 5.1-2

PERFORMANCE OF A SIX-ACRE COOLING POND

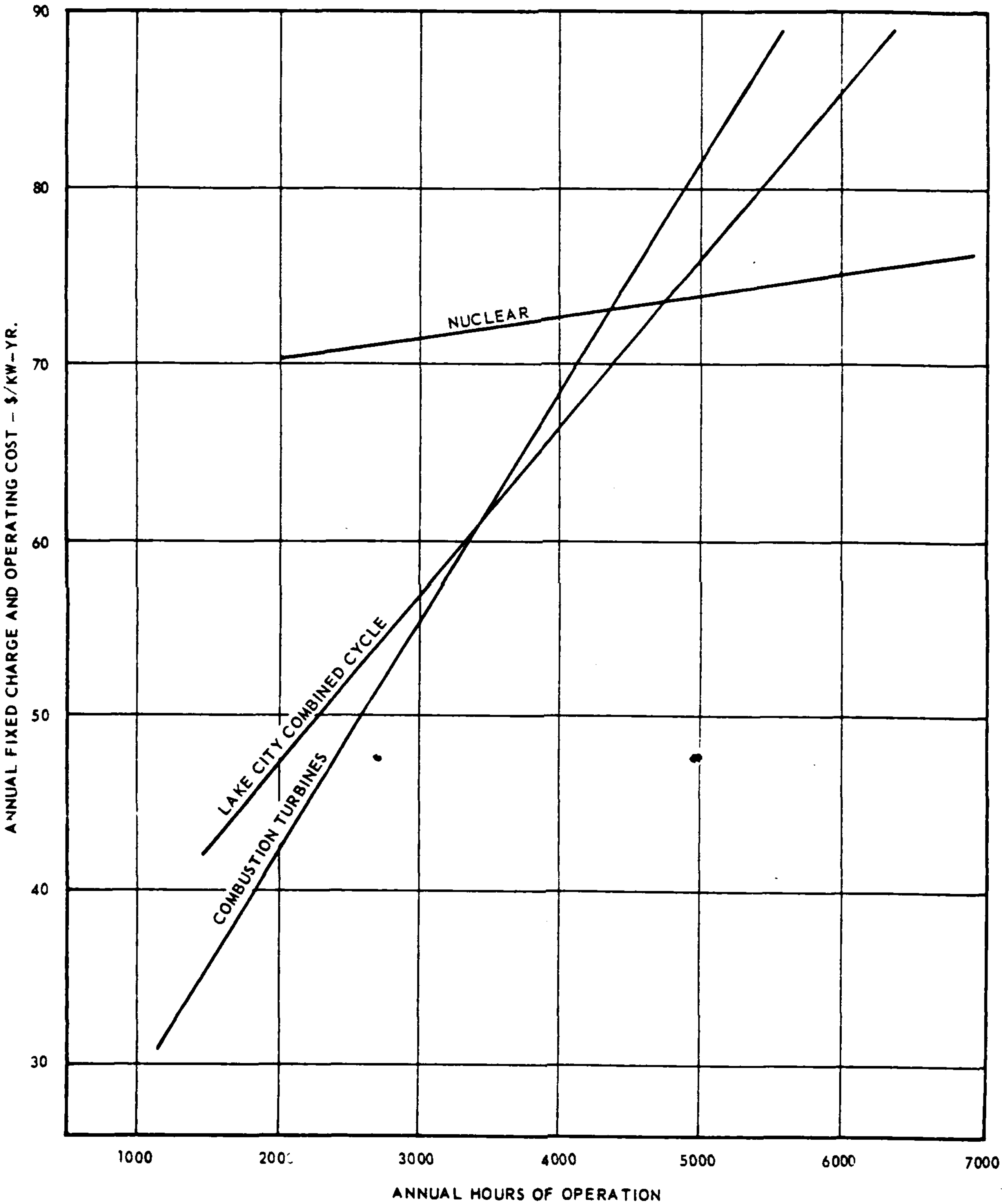
Month	Cooling Tower Effluent Temperature °F	Pond Final Temperature °F	Temp. Diff. Between Pond Effl. & Lake °F	Dilution Flow for 2 F Diff. With Lake GPM
January	53.0	37.2	4.2	1540
February	53.0	38.5	5.5	2450
March	53.0	43.7	10.7	6100
April	60.3	51.0	8.2	4350
May	68.6	65.4	11.8	6850
June	80.5	76.0	8.0	4200
July	83.0	80.0	6.6	3220
August	85.2	79.0	3.8	1260
September	78.7	71.3	5.1	2170
October	72.2	60.3	3.1	770
November	62.1	48.1	3.5	1050
December	53.0	39.0	6.0	2800

PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



COMPOSITION OF SCHEDULED GPU CAPACITY
FIGURE 5–1

PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



COMPARATIVE ANNUAL COS
LAKE CITY COMBINED CYC
VS OTHER GENERATION
FIGURE 5-2

REFERENCES SECTION 5.2

5.2-1 Yee, W. C., 1972. Thermal aquaculture: engineering and economics. Environmental Science and Technology, 6(3): 232.

5.2-2 Krenkel, P. A., and F. L. Parker, 1969. Biological aspects of thermal pollution. Vanderbilt University Press. 407p.

6.0 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

6.1 GENERAL

The construction and operation of the proposed units will have a relatively insignificant environmental impact. The local short-term effects on the environment will be limited to the thermal (cooling tower blowdown) discharge and the neutralized chemical discharges from the settling pond to Lake Erie and thermal, particulate, and gas discharges to the atmosphere. It should be noted that all of these discharges meet Federal and State standards by a wide margin.

6.2 SHORT-TERM/LONG-TERM EFFECTS

The short-term effects of the stringently limited thermal and chemical liquid discharges are expected to have a virtually undetectable impact on aquatic life and lake water quality. Likewise, the long-term effects of the limited thermal and chemical liquid discharges are estimated to be wholly immeasurable due to the minute volume of discharge; and more importantly the fact that the state of Pennsylvania has issued an Industrial Waste Permit with regard to plant discharges means that the plant is in accord with established standards which were created to minimize environmental effects.

The short-term effects of the thermal, particulate, and gas discharges to terrestial plant and animal life are expected to be absolutely minimal as a result of combusting the least contaminated fuel available on the present market. Likewise, the long-term effects of the thermal, particulate, and gas discharges are estimated to be absolutely minimal. In addition, plant gaseous and particulate effluent emissions and ground level concentrations are substantially less than Federal and State standards which are designed to minimize effects on plants and animals.

6.3 SHORT-TERM/LONG-TERM USES AND PRODUCTIVITY

The production of electricity contributes to the enhancement of man's environment. The use of electricity in the northern region of Pennsylvania served by PENELEC is increasing. Utilization of land, air, and water resources during the life of the plant is expected to result in benefits to the productivity of the applicant's service area in terms of electric power to be produced by the proposed combined cycle plant and in terms of the industrial, commercial, and public services which critically depend upon electric power. In addition, employment opportunities for the community will be created via the construction and operation of the proposed plant.

Although potential farm land is being utilized for power production, equally productive farmland is available in the nearby vacinity which is not being utilized for farming and could be utilized in the future for that purpose if required. In

addition, the plant could be disassembled in the future and returned to its original condition as farmland.

The fact that applicable Federal and State standards for gaseous and particulate emissions, thermal and chemical discharges and fuel storage facilities are met by the proposed plant means that short-term effects will be minimal and the enhancement of long-term productivity will be assured.

7.0 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES SHOULD THE PROPOSED ACTION BE IMPLEMENTED

7.1 PERMANENT COMMITMENTS

Construction and operation of the proposed combined cycle plant will involve an absolutely irreversible and irretrievable commitment of manpower and fuel throughout the life of the plant.

7.2 TEMPORARY COMMITMENTS

Construction and operation of the plant will involve a temporary commitment of land use and building materials throughout the life of the plant; however, it is entirely feasible to dismantle the plant, reclaim and recycle the building materials, and render the site useable for other purposes.

8.0 COORDINATION WITH OTHERS

Pennsylvania Electric Company has conducted various meetings and briefings with officials as well as citizens of the Lake City area on the proposed Lake City Generating Station. These discussions were started in January 1972.

In addition, notice was posted on the proposed site as well as an announcement in the local newspapers.

8.1 PUBLIC PARTICIPATION AND CITIZEN GROUPS

The attendees of these meetings and the issues that were discussed during the respective meeting are listed below.

a. Commissioners of Erie County
Erie County Controller
Mayor and Councilmen of Girard, Lake City, and Fairview Boroughs
Supervisors and Officials of Girard and Springfield Townships
Publishers and Editors of local newspapers, radio, and TV stations
Tri-Borough Archers Association

   Issues discussed included type of buildings, noise levels from turbines, type of fuel, method of fuel delivery, use of water, capacity of generators, number of employees, economic impact, construction jobs, recreation facilities, coordination of proposals with Erie County's overall planning, and the energy supply of the region.

b. A slide presentation was made at the annual meetings of the Northwest Division of the Pennsylvania Federation of Sportsmen's Clubs and the Lake City Chamber of Commerce.

c. Technical details and composition of the discharge to be expected from the project were discussed at meetings in Meadville and Erie with regional air and water control engineers of the Pennsylvania Department of Environmental Resources, the Pennsylvania Fish Commission, and the Erie County Health Department.

d. A public hearing on the application was held by the Pennsylvania Public Utility Commission in Erie. No objections were filed by anyone.

   Reaction to the proposal has been most favorable. Officials have expressed a desire for having another source of electric generation in Erie County.

Furthermore, notice of the proposed Lake City Generating Station was published in local newspapers for four consecutive weeks; and written descriptions of the proposed project were distributed to the local Congressman and State Legislators.

8.2 GOVERNMENT AGENCIES

Copies of the Draft Environmental Statement, dated February 7, 1973, were sent to the following agencies for comment:

Agency	Response Date
Department of Interior, Office of Environmental Project Review	4 May 1973
Great Lakes Basin Commission	No Comments received
National Resource Economics Division, Department of Agriculture	No Comments received
Department of Commerce	19 March 1973
Ninth Coast Guard District	No comments received
Federal Highway Administration, Baltimore, Maryland	No comments received
Federal Power Commission	9 May 1973
Environmental Protection Agency, Philadelphia, Pennsylvania	26 March 1973
National Marine Fisheries Service	No comments received
Federal Aviation Administration	8 March 1973 (No comments)
Great Lakes Laboratory, State University, College at Buffalo	No comments received
Pennsylvania State Planning Board	No comments received
Erie County Planning Commission	20 February 1973
Department of Environmental Resources, Commonwealth of Pennsylvania	2 April 1973
Dr. S. K. Stevens, State Liaison Office for Historic Preservation, Commonwealth of Pennsylvania	No comments received
County of Erie, Commonwealth of Pennsylvania	No comments received
Pennsylvania Fish Commission	7 May 1973
Erie County Commissioners	No comments received
Erie County Department of Health	20 March 1973

All of the comments received, along with the associated responses, are given in this section. Copies of the original correspondence from each agency are included in Section 8.4.

ERIE METROPOLITAN PLANNING DEPARTMENT,
ERIE COUNTY COMMUNITY SERVICE CENTER, ERIE, PENNSYLVANIA

Comment

Energy Source - from page 1:

This 250 MW Power Plant will use a low sulfur (.5%) No. 2ASTM Fuel Oil as its prime energy source. Based upon data supplied the facility will use some 61 million gallons, or 1.45 million barrels of this fuel per year. Over the project's 30 year life span, 1,833 billion gallons would be required. We highlight these figures to point out that the facility will have relatively high demand of low sulfur fuel oil - an energy source apparently in limited supply. Current inquiries into the Erie Market Area indicates that fuel oil is currently being informally rationed by some companies. In addition, we note that fuel oil shortages are evident in other areas this year, the Metropolitan New York Area being the most noteworthy example.

Response

The life time demand should be 1830 million gallons rather than 1833 billion gallons of oil. Oil is available in the Erie area. The type of unit choosen for Lake City is more efficient than the single cycle gas turbine machines, which burn No. 2 fuel oil also. Fuel will be diverted to this unit from simple cycle units making better use of the oil. With the construction of the Lake City plant, a less efficient plant will be retired which will save fuel and diminish the impact on the environment.

Although fuel is being informally rationed at this time, by the date of commercial operation, fuel oil will be available for this plant.

Comment

Alternate Types of Generation - from page 1:

In addition to the fuel oil energy source, two other alternate base energies were discussed in a cursory fashion by this report, coal and nuclear. Although neither were regarded as currently feasible due to the location and purpose of the station (i.e. intermediate rather than base load) this office cannot dismiss them as changes in relative fuel cost, or annual hours of operation can change the relative economic attractiveness of three options (Note chart of figure 5-2 which seems to indicate that an increase of 20% of anticipated annual operation for this facility may make nuclear production attractive.

We bring up these points to point out that the potential of a conversion of this station of other energy modes (or variations of other grades of oil) in the future must be considered as within the laws of relative probability. If such conversions are considered likely they may coincide with the estimated 24,000 hours of operations (roughly 6 years) overhaul schedule. If such an energy mode conversion is proposed in the future, it must be considered as a viable possibility and should not be considered as an unexpected "crises" type of problem. Any energy conversion must receive the same methodical investigation that the current facility is receiving.

Response

Due to the present demand and the projected growth of the area, the 250 MW combined cycle type unit is the appropriate type of unit to install. In the Erie Area, there is a demonstrated need for this generation and a combined cycle plant, due to the design of its components, can be erected and operated in the required time. A nuclear unit could not be made available until the late 80's and a coal fired unit (which probably would not compete economically with a nuclear unit due to fuel availability at this site) could not be constructed until the mid 80's. There is no way to convert the PACE plant hardware over to a coal or nuclear type unit. It must burn #2 fuel oil, natural gas (which is unavailable in the area), or selective grade of crude oil.

Comment

Soil Erosion and Sediment Control - from page 2:

Because over 25 acres of earth clearance is contemplated, an erosion and sediment control plan may be required under current DER criteria. The Erie County Health Department should be consulted on this point. In any event, this office most emphatically recommends that Penelec and its contractor consult with the Erie County Soil Conservation District/SCS (United States Department of Agriculture) for the preparation of proper soil management and drainage practices during and after construction.

Response

Due to precedent permits, the necessity for this permit is negated. However, the need for erosion and sediment control is recognized. The following protective measures are planned during construction and operation of this station:

a. Only those areas that are required for immediate construction shall be cleaned of vegetation and these areas will be left covered as long as practical.

b. Dust from construciton parking lot and access roads will be controlled by sprinkling with water or a moisture absorbent chemical dust palliative.

c. Erosion caused by rainfall will be controlled by either maintenance of vegetative cover or by sediment control facilities.

d. The existing vegetative cover will be maintained or replaced after local construction by one that grows rapidly.

e. Sediment control structures such as settling ponds, ditching, and a storm drainage system will be employed to control drainage over large areas during construction. The storm drainage system will be put in place during initial site preparation and be operational early in the construction phase.

f. As sediment builds up in the basins it will be removed, shaped to conform to the surrounding area, and seeded.

g. After construction, the area will be landscaped and the storm drainage system will remaim as part of the permanent installation.

PENELEC's engineers will consult with the Erie County Health Department and the Soil Conservation District of the U.S. Department of Agriculture as recommended.

Comment

Water Effluent - from page 2:

According to the Statement water effluent will meet both thermal and other DER Standards. This office notes the waste water from the demineralization process will be mixed with the cooling tower blow down and other water wastes to obtain permissible limits. Because the demineralized waste represents the most constant potential pollutant (outside of possible oil problems), it should have a fail-safe method of handling. In addition, we recommend a monitoring of water effluent at discharge points to determine that the proper thermal dispersion is occurring.

Response

The waste water from the demineralization process will be collected in a below-grade collection tank. The neutralized waste material will be pumped from this tank by a manually operated variable discharge pump which will be operating only during times of cooling tower blowdown. The manual operation will preclude untreated waste water from being discharged to the lake due to faulty instrumentation. It will be the responsibility of the roving operator to periodically visually inspect the level of the waste water in the collection tank and to take remedial action should it be warranted.

The effluent will be monitored continuously in the mixing box prior to discharge to the lake. A mathematical model of the mixed temperature in the lake will predict the temperatures. During the first year of operation, periodic measurements of the actual lake temperature around the outfall area will be made to correlate and calibrate the model.

Comment

Air Pollution - from page 2:

The plant will be within 1½ to 2 miles of significantly populated areas of Lake City. Because westerly winds are quite common locally, especially in summer months, emmissions from the plant may present problems even if they are within EPA/DER standards. Beyond that point this office notes all air pollution extrapulations are based upon nominal plant operations. Recently in New York fuel shortages caused high sulfur fuel to be used. Such a local contingency may arise and a plan to offset any adverse results should be devised.

Response

A revised Appendix A is included in this final report written in conjunction with Dr. J. M. Austin. The revised summary on page A-4 represents values not only for the maximum calculated concentrations, but presents the average (normal) values which are the values expected most of the time. These values show the air contamination by this plant is minimal and should cause no harm to the air quality of this area.

Combined cycle plants of the type under consideration in this report have combustion turbines and heat recovery steam generators that limit the kind of fuel which can be successfully burned in the plant. Besides the planned fuel (ASTM No. 2 fuel oil) certain crude oils would be the only other candidate fuels. None of the crudes that have been approved for use in the combustion turbines and heat recovery steam generators would have a sulphur content in excess of 0.5 percent. Therefore, there need be no concern that supply conditions may make necessary the use of high sulphur fuel and the resulting higher emissions. This plant is not designed to burn the lower grades of high sulphur fuel, therefore, this contingency plan is not required.

Comment

Editorial from page 3:

One final note of this review would be the need for man and his energy sources to be compatible. Penelec should be commended upon their efforts to minimize adverse affects of this facility. However, even this nontechnical review indicates that such a task is indeed difficult. This office may suggest that if the increasing use of energy cannot exist without producing deleterious effects for man and his environment then some rational method to limit or ration energy forms must be devised and followed.

Response

No response is deemed necessary.

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Jamaica, New York

Comment

None.

Response

None necessary.

THE ASSISTANT SECRETARY OF COMMERCE
Washington, D. C.

Comment

Lake Erie - Physical Interpretation - from page 1:

Inspection of the draft environmental impact statement reveals a number of apparent conceptual errors which could eventually lead to unfortunate operational difficulties as well as to possible unnecessary adverse impacts upon the environment. The conceptual errors to be discussed can best be summarized by extracting the last four lines of paragraph B.1.1. of Appendix B of this draft environmental statement. "... Lake Erie, because of its size and depth: (second smallest of the Great Lakes and with an average depth of 58 feet - 210 feet maximum depth) may be treated more as an ocean than as a lake or inland reservoir." Lake Erie cannot be treated more as an ocean than as a lake. To the contrary, one could regard the west, central and east basins of Lake Erie as separate but interconnecting lakes each with different physical, chemical and biological characteristics. Each basin has a separate and distinct circulation pattern as well as a separate and distinct thermal regime. The west basin which is the most shallow and turbid of the three basins has its eastern most boundary formed by the Point Pelee - Lake Erie Islands complex. The eastern boundary of the central basin is formed by a sand and gravel reef extending across the lake just west of Erie, Pennsylvania. The proposed power plant which is the subject of this draft environmental statement is located at the extreme eastern end of the central basin of Lake Erie.

Response

The paragraph dealing with treating Lake Erie as a small ocean has been deleted from this report.

Comment

Water Quality - from page 2:

A conceptual error is committed in paragraph 2.5.1 Present Water Quality and Use, by making reference only to "present water quality" rather than making reference to seasonal, short term and long term ranges in concentration of the various chemical and physical parameters listed on page 2-7. Furthermore, the report fails to state when the samples analyzed were collected and whether the figures shown in the table are the result of analysis of one sample from one site, the average of a sample or samples taken at the three points mentioned or if it is the result of analysis of combined samples.

Response

Information on water sampling and the effects of water quality on the design of this plant is presented in the revised paragraph 2.5.1 and an added Table 2-13.

Comment

Lake Water Physical-Chemical Characteristics - from page 2:

In paragraph 2.6.1 Physical-Chemical Characteristics, an error is made by implying that physical-chemical characteristics of the water at the city of Erie intake are comparable to physical-chemical characteristics at the proposed power plant intake site. The proposed power plant intake is less than two thousand feet offshore in the central basin of Lake Erie. The Erie, Pennsylvania intake is 6000 feet off Presque Isle which itself juts out several thousand feet from the mainland shore and it is located in the eastern basin. The nearest intake in the central basin most similar to the proposed intake is located at Conneaut, Ohio and should be used as the standard for comparison. The Conneaut intake is 13 feet below low water datum. Because the Erie and Conneaut water intakes are located in different basins, fundamental differences in water quality are apparent. Intrusion of the hypolimnion at the Conneaut intake and along the south shore of the central basin is more severe than it is at the Erie intake because of the hydrography. This condition is apparent from inspection of records of such parameters as dissolved oxygen and water temperature. Since a temporary increase in dissolved solids and hardness is generally associated with hypolimnion water, intrusion of the hypolimnion could cause a decrease in efficiency of the cooling tower operation.

Response

Water samples were taken at the plant site and were used as the basis for the design of the power plant and auxiliary equipment. The reference to samples 6000 feet off Presque Isle was only from the viewpoint of the aquatic ecosystem. In Section 2.6.1 of the Draft EIS, it is stated that at the City of Erie, water temperature ranged from 33 F to about 80 F. This fact was introduced from the viewpoint of the aquatic ecosystem rather than any physical-chemical characteristic that would be influencing the plant equipment design or operation. The plant intake water temperature, dissolved oxygen content, or turbidity will not affect plant design or operation. It is a fact that turbidity values as high as 25 JTU were observed: but no great significance was attached to this; and the reported 5 JTU in the synthesized analysis was believed to be a more representative value. The operation of this plant will not contribute to the turbidity that exists in the area.

The dissolved solids content of the lake water raises a sharper question. The scheme of control (Langelier Index) for scaling and corrosion protection will necessitate monitoring of the lake water for bicarbonate hardness, dissolved solids, pH, and temperatures. This index will be the determining factor in deciding the degree to which the intake water may be concentrated in the cooling tower circuit. The design value of 190 ppm adopted may very well increase sharply on a short term basis, as the reviewer indicates. The resulting concentrated water in the cooling tower circuit increases from the predicted 380 ppm (2 concentrations). However, the resulting operation will not lead to any problem with cooling tower efficiency as the reviewer suggests. While it is correct that higher concentrations of salts act as a vapor pressure depressant and reduce the cooling action, the effect on tower performance will not be measurable at the solids concentrations that hold for a fresh water cooling tower of this type.

Comment

Water Usage - from page 2:

An error of omission is made in paragraph 2.5.1 by leaving out completely any discussion of water use. This is a serious omission as paragraph 1.3.1.1 Demand/Supply Forecast, points out that maximum power plant usage will occur during the peak power demand summer months. This, of course, is the same time that peak recreational water and land use occur and when the most serious water quality problems occur.

Response

Information on water use can be found in the Revised Section 2.5.1 of this report.

Comment

Turbidity - from page 3

Turbidity may be much higher at the proposed intake than 5 JTU indicated in the statement. Formation of a thermal bar in early spring causes highly turbid run-off to be held in a circulation cell along shore. Turbidity is also elevated due to resuspension of bottom material by wave action. At Conneaut, Ohio intake in 1970, turbidity was greater than 5 JTU most of the time and 10 JTU or greater about one third of the time.

Response

Information on turbidity can be found in Revised Section 2.5.1 and the added Table 2-13.

Comment

Operational Problems Due to Dissolved Solids from page 3:

Dissolved solids in Lake Erie have been rising sharply since about 1910 and will continue to rise in the foreseeable future. At what point dissolved and total solids will become a serious operational problem as far as cooling tower efficiency is concerned is not made clear in the statement. It should be noted however that total solids are sharply variable on a short term basis and have been recorded at a concentration as high as 416 ppm at Conneaut intake on July 7, 1970.

Response

The effect of dissolved solids on operation of the plant has been discussed in a preceeding response in this series.

Comment

Cooling Tower Environmental Impact - from page 4:

There is no assessment of the cooling tower impact upon the environment

in this report. This again is a rather serious omission. A discussion of atmospheric effects caused by cooling tower operation in the near shore area of Lake Erie is in order. What would be the result of cooling tower operation during a "lake effect" snow storm? What effect will cooling tower operation have during temperature inversion periods?

Response

The environmental effects of the cooling tower will be creation of a visible plume, evaporation of water to the atmosphere, drifting of water droplets, blowdown of water to the lake, and creation of noise. These effects have, in the main, all been addressed in the EIS as the following:

a. Blow down has been discussed at "1.4.3 The Cooling Scheme," "1.6.3.2 Discharge Structure," "3.3.3.1.11 Impact of Cooling Water Intake" and "Appendix B. Thermal Effluent Considerations".

b. Evaporation loss has been discussed in "1.6.1.4.2 Cooling Tower".

c. Noise has been discussed in Section "3.2.5 Noise".

d. Visible plume has been discussed in Section "3.2.5 Climate".

The cooling tower exhaust plume will rise vertically in the absence of wind due to the buoyancy of the warm, moist air. If a strong wind is blowing, the plume may be drawn downwards in the negative pressure area at the leeward side of the tower and will be slow to rise as it proceeds downwind while being dispersed and diffused into the unsaturated air.

In fog the tower operation will contribute further to the fogging condition. In a low level inversion, if the plume buoyancy is great enough, it may pentrate the inversion and continue to rise. If the inversion is strong, the plume will rise to the stable layer and spread outwards. We do not anticipate any problem with drift. Drift eliminator design has benefited greatly in recent years with the current interest in salt water cooling towers. Present designs are credited with being able to maintain drift to the low value of 0.004 percent of circulation which would be no more than 4 gpm at the Lake City plant.

During a "lake effect" snowstorm, the cooling tower would be operating under cold weather procedures in order to avoid ice formation on the louvers. The fan speed would be reduced, which would have the effect of reducing the air flow and increasing the outlet temperature of the exhaust. Consequently, while the exhaust would exit the tower at lower velocity, it would be quite buoyant.

A report by Dr. C. L. Hosler, Jr., on the cooling tower and its impact on the environment can be found in Appendix E of the report.

Comment

Fuel - from page 4:

Other questions arise regarding the selection of a power plant which requires high quality, low sulfur fuel oil which is likely to be high priced and in critically short supply for some time to come.

Response

See the Response to the Metropolitan Erie Planning Board Comments.

Comment

Siting - from page 4:

One must question the selection of a site for power plant construction adjacent to the last remaining portion of the south shore of central Lake Erie where body contact water recreation is still a viable activity. Hundreds of thousands of persons travel to this area annually during the period June through August to spend millions of dollars on land and water recreation.

Response

The construction and operation of the proposed power station will be within water and air quality standards of this region. It, therefore, will not make this area any less attractive for the recreation described. In fact, the power generated will ensure that the area can be better used for recreational purposes. The area used by the site is not particularly suited for recreational development, and there is similar land undeveloped for miles in each direction.

Comment

Air Quality - from page 4 and 5:

From the discussion in Appendix A of the subject document, it is unclear what has been computed in the case of "maximum 3 hour SO_2 ground level concentration" as is shown in exhibits A-11 and A-12. Is this an average 3-hour maximum or is this a discrete event maximum? The governing air quality standards (exhibit A-9) clearly state with regard to the three hour value that "the maximum three hour SO_2 concentration not to be exceeded more than once per year is 1300 micrograms per cubic meter". Thus, in comparison, what should be computed is the maximum credible 3-hour event that could occur at least once a year. In our view, this maximum event would occur under what is called downwash conditions using the third equation on page A-3 where the average indicates a 3-hour average. A very graphic smoke plume photograph of this condition is shown in figure 3.20 of the publication "Meteorology and Atomic Energy, 1968" (Clearinghouse for Federal Scientific and Technical Information, TID-24190). The building in the photograph is similar in size and shape to the Lake City Station, even to the 4 short stacks above the roof. The Lake City Unit is described as having stacks at a height of 85 feet with a building height of 65 feet. Thus the stacks are 20 feet above the roof and within the building wake.

Using the equation on page A-3 and assuming neutral conditions (Pasquill Type D), a wind speed of 2 m/sec, a mixing layer of 40 m, and a SO_2 source term of 147 grams/sec (exhibit A-4) we compute a concentration of 10,000 micrograms per cubic meter at a distance of 1 km downwind for a 15-min average concentration. Extending the 15-min average to a 3-hr. average

by the use of table 5-1 of reference A-1, the concentration becomes 6000 micrograms per cubic meter. The same value can be obtained using the equation IV-8 of reference A-4 with a building cross section of 20 x 60 meters and a c factor of 1/2.

In summary, we compute a maximum 3-hour SO_2 ground concentration of 6000 micrograms per cubic meter which is about 40 times greater than in exhibit A-12 and also above the National Secondary Ambient Air Quality Standards. The meteorological parameters we have assumed are not an infrequent occurrence.

Response

A revised Appendix A and a new Appendix D have been added to answer these questions related to air quality. As these Appendices show, there will be no violation of the governing air quality standards.

As discussed in Appendix D, the proposed 85 ft stack would keep the ground level concentration within the National Secondary Ambient Air Quality Standards with a safety factor of 1.5. Dr. Halitsky recommends that if the stack height could be increased to 110 ft it would provide a safety factor of 2.7; or a wind tunnel model test should be conducted to verify the 1.5 safety factor, which he calculated based on the proposed plant with the 85 ft stack. PENELEC will conduct model studies to determine the proper stack height, if they elect to keep the stack height below the 110 ft that is recommended.

ERIE COUNTY DEPARTMENT OF HEALTH
Erie, Pennsylvania

Comment

Editorial - from page 1:

With the exception of a few specific points, this office would like to make the general comment that the study is not decisive enough in its statements. Throughout the study one repeatedly sees phrases such as "might", "may have," "probably", etc. These statements are not specificenough and this office recommends that definite statements be made as to any harmful environmental effects expected from the project.

Response

Definite statements were avoided where the position could not be stated beyond a reasonable doubt. Many of the answers to the definite impact due to the construction and operation of the plant can only be truly determined after the plant is installed and operated. The following examples are offered to clarify this point:

Paragraph 3.2.1.1.2 states, "The sulphur dioxide emissions from the Lake City plant will probably cause no damage to vegetation in the area." This position was taken because no terrestrial study had been made which would have determined the vegetation indigenous to the plant site area. If, however, the vegetation is that which is common to the general area, there would be no deleterious effects at the concentrations of sulphur dioxide which will apply at ground level when the plant is operating. This is seen from the low level of the sulphur dioxide which is well within the Secondary Air Standards.

Paragraph 3.2.2.1.3 states, "The thermal effluent will probably have no measurable impact on BOD." A strict review has been made of the in-plant processes and can identify no organic contribution which would create a biochemical oxygen demand. Furthermore, with 79,000 gpm cooling tower circulation in the plant, the blowdown to the lake will approach saturation of dissolved oxygen. We could therefore, reasonably remove the word probably from the statement.

Paragraph 3.2.4.1 states, "The only other structure which may equal or exceed the 85 feet height will be a water storage tank whose requirements are presently undefined." This was so stated because the height of the water tower has not been finally established. The height of this tank will be governed by the water pressure required throughout the plant for process and fire fighting equipment.

Comment

Outfall Impact - from page 1:

In our review, the following specific questions came to mind. First, it was noted that macroinvertebrate data was not gathered from the area in question. This office recommends that sediment analysis be made to gather the information from the local area. Secondly, does any fish spawning take place within

the 1° mixing zone? If so, what effect will the thermal discharge have on this activity? Also, this office would like to suggest that some form of mechanical screen cleaning might be wise on the intake pipe. Algae conditions can become severe in late summer and some difficulty may be encountered from this algae building up on the screen.

Based on the information submitted and our knowledge of the area, we believe that the proposed discharge will have minimal or no adverse effects on the surrounding water quality. However, we do believe that the above information should be gathered, no only to further support their position but to enable the area to be monitored after installation of their facilities.

Response

No significant impact on plankton or fish life was recognized for the following reasons:

a. Small quantity of heated blowdown water (1400 gpm).

b. Planned use of thermal diffuser.

c. Small area of mixing zone (with zero current in the lake, which is the most adverse condition. The mixing zone dimensions will be 1440 ft. x 820 ft. The surface water temperature within this area will not exceed the natural lake temperature by more than 2 F).

A study of the aquatic ecology in the Lake Erie area covering the proposed location of the water intake and discharge area, will be made prior to the installation of the plant. The intake will be monitored to determine if there is an algae problem. If a problem is encountered, the appropriate action will be taken to keep the screen clean.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, REGION III
Philadelphia, Pennsylvania

Comment

Air Quality - from page 1

We have been able to verify the results of the applicant's modeling effort because Appendix A, "Evaluation of Stack Emissions and Dispersion Analysis" is complete. Errors have been discovered in formulas A-1, A-3 and the downwash formula. Terms have been improperly defined, e.g., the plume rise for various conditions. Are these averaged plume rises under many conditions, or was one calculation of plume rise made for an average condition? We suggest that Appendix A of the EIS be completely rewritten following the suggestions in Attachment 1, "Guideline Checklist for Evaluation of Fossil Fuel Power Plant Impact on Air Quality".

The draft fails to discuss CO emissions and the use of metals in the fuel (especially manganese), either currently or in the future, in order to reduce the opacity of emissions. It further neglects to discuss guarantees that a more polluting fuel will not be used in the future. (Page 5-5 indicates that a capability exists for burning No. 6 or crude fuel oil).

Exhibits A-3 illustrates that the project will be a significant source of NO_x. It is not clear how the low NO_x emissions from the waste heat boilers (p. A-3) will be achieved. There are currently available methods to control NO_x emissions from gas turbines.

Response

A revised Appendix A following the reference EPA publication and a new Appendix D on downwash are included in this report. The modeling shows the resulting emissions and resulting ground level concentrations are well within the governing standards.

As discussed in Appendix D, the proposed 85 ft stack would keep the ground level concentration within the National Secondary Ambient Air Quality Standards with a safety factor of 1.5. Dr. Halitsky recommends that if the stack height could be increased to 110 ft it would provide a safety factor of 2.7; or a wind tunnel model test should be conducted to verify the 1.5 safety factor, which he calculated based on the proposed plant with the 85 ft stack. PENELEC will conduct model studies to determine the proper stack height, if they elect to keep the stack height below the 110 ft that is recommended.

The CO question is covered in the revised Appendix A on page A-5. There is no plan for the use of additives to reduce the opacity of the emissions due to their low level.

Combined cycle plants of this type under consideration in this report have combustion turbines and heat recovery steam generators that limit the kind of fuel which can be successfully burned in the plant. In this type, only ASTM No. 2 fuel oil, and certain crude oils should be used. None of the crudes that have been approved for use in the combustion turbines and heat recovery steam generators would have a sulphur content in excess of 0.5 percent.

Comment

Pending Air Quality Standard - from page 1:

We invite your attention to the fact that Standards for gas turbines are due to be proposed by EPA in the near future. These Standards will probably limit emissions approximately to the levels permitted for new boilers - this source would exceed such a NO_x Standard several fold.

Response

The question of new emission standards on combustion turbines is addressed in the revised Appendix A of this report.

Comment

Intake and Outfall Siting and Discharge - from page 2:

The discussion of alternatives should emphasize techniques for reduction of emissions and modifications in the location and design of cooling water intake and discharge structures. (See below)

The draft states that the cooling water intake structure will have a vertical approach velocity. We submit that a horizontal approach velocity might be preferable. This is indicated in a technical paper entitled,"Application of Mechanical Systems to Alleviation of Intake Entrapment Problems" by H. S. Riesbol and P.J.L. Gear. This report was presented at a conference entitled "The Engineering Aspects of Siting and Operating Power Plants" in Washington, D.C., February 13-14, 1973 and states:

"The velocity cap over the mouth of a vertical submerged bellmouth intake was found in some tests to reduce greatly the rate at which fish were drawn into the intake. It does not however eliminate the problem. This modification, which provides a horizontal approach flow into the bellmouth, was developed after fish had been observed to react to horizontal velocity changes while remaining largely oblivious of vertical velocities. The velocity cap is used on most of the offshore intakes in the Los Angeles area (3). A section of a typical installation is shown on Figure 2."

Figure 2 "Offshore Intake With Velocity Cap" of this report is attached to our comments.

This report also observes that it can be quite important to locate the intake away from areas where fish would naturally congregate. The following paragraphs convey this point:

"The siting of the intake can have a marked influence on the quantity of fish drawn in with the diverted water. To reiterate what is considered to be one of the most important factors in alleviating entrapment problems, this influence of the ambient fish and their behavior must be given its proper weighting and consideration during the siting and positioning of intakes.

Response

A velocity cap designed similar to those used in the Los Angeles area will be installed on the intake structure. See revised Figure 1-5 for detail of the velocity cap. Also a refuge chamber which will provide for the installation of a bladeless impeller type for fish transfer should this be necessary.

Comment

Effect of Lake Bottom Water Discharge - from page 3:

Provided the biological, ecological and natural flow surveys are completed in

time, it is possible greatly to reduce the entrapment problem by locating and orientating the intake to divert water from an area of low natural fish population. It should be noted that the fish regime adjacent to a plant can be materially changed by its operation, and any tendency to recirculation of heated water could be expected to aggravate a fish problem through the apparently usual attractiveness to fish of the warmer water. There is thus an added objective in ensuring the operational separation between intake and outlet.

The final EIS should describe to what extent the siting of the intake (for the proposed plant) will take into account such factors.

A related potential problem is the stagnation of heated water in the vicinity of the plant. We gather from the EIS that currents are not consistent and uniform. We wish to know how often such currents will fail to promptly remove the heated water from the plant vicinity. What conditions could lead to such stagnation? How often might they occur? For how long a duration? How large would the resulting area of raised temperatures be and how hot? We are concerned that such stagnation might (a) block fish from near-shore areas utilized during various times of year or (b) attract fish to the vicinity of the intake with resultant losses through impingement.

We note further that during the winter the plume of heated water may be expected to sink. What effect will this have on the distribution of excess temperature, recirculation and on the attraction of fish to the vicinity of the discharge (or intake)?

Response

The lake bottom off shore of the proposed site is composed of sand, clay, bedrock, and gravel with some large bolders. Some sedimentation has occurred in the area. Very little, if any, vascular plant life has been found in this area of lake bottom. Fishes of a number of species commonly found along the Pennsylvania shore of Lake Erie can be expected to use the area. A study of the aquatic ecology covering the intake and discharge areas will be made at the site.

In the matter of the influence of the heat plume on the fish regime we would again point to the small quantity (1400 gpm) of water and the low heat content of this water. While it is generally agreed that fish are attracted to the heated outlet from power plants the calculated dimensions of the plume have the small proportions of 1,440 feet by 820 feet under critical stillwater conditions. The surface water temperature at this perimeter will be only 1 F above the general lake surface temperature. At other times the shape of the mixing zone will be elongated according to the direction and magnitude of the lake currents.

The site is located in the central basin of Lake Erie, and in this basin the water circulation is composed of three regimes: surface, intermediate, and bottom flows (reference "Pollution of Lake Erie, Lake Ontario and International Section of the St. Lawrence River" Vol. 2 Lake Erie, International Joint Commission 1969). While data on this movement are limited, sufficient information exists to define the basic characteristics of the circulation. Surface flow is the mean movement occurring in the top three feet of the water column. The surface flow in the central basin is directed eastward and to the right of the longitudinal axis of the lake. The surface flow pattern is applicable for the

flows occurring along the shoreline. The net flow speed is in the range of 0.03 to 0.10 fps while the average current speeds regardless of direction are from 0.25 to 0.33 fps. Surface flow patterns are applicable for the site of the proposed intake and diffuser. These currents are erratic. The "Outfall-Diffuser System Feasibility Study" made for the Hammermill Paper Company by Engineering Science, Inc., Oakland, California, indicates that in the area of the lake located east of Presque Isle Peninsula, the lake water currents are greater than 0.15 fps, 80 percent of the time. The lake water currents at the unprotected shoreline of the plant site will be greater than these and so by analogy we may deduce that currents at the plant site will be greater than 0.15 fps at least 80 percent of the time. Since 0.15 fps is the maximum water current at which a stratification layer with a 2 F differential can be maintained, the occurrence of stratification of the diluted effluent plume will be less than 20 percent of the time. Again we would point out the Figure 1-6 of the EIS shows the 1 F and 2 F surface isotherms that apply under the critical condition of stillwater. In winter when water temperatures fall to 39 F (point of maximum density) and below, the buoyant jet from the diffuser may lose its buoyancy before it reaches the surface of the water. As a result the effluent field would be trapped below the water surface. The reviewer should, however, bear in mind that for this installation we are speaking of ten individual diffuser ports each releasing 140 gpm. We cannont visualize any impact from this.

<u>Comment</u>

Demand Modification - from page 3:

We would like to see the possibility of load shape modification by changes in the prices charged for peak versus non-peak discussed as an alternative to the Lake City Station. The following question among others, should be addressed: 1.) What prices are charged for peak (or intermediate) and non-peak power to different categories of customers, i.e. residential, commercial,and industrial? 2.) How elastic are the peak power demands of these various users? Discuss the elasticity over different time periods: one year, five years, ten years. 3). How does the price charged for peak power compare with the marginal generating cost in each case?

We do not suppose that price changes, even if desirable in their own right, could modify the hourly demand curve soon enough to obviate the need for the Lake City Station. However, the timing to future units might well be affected. Moreover, the resulting changes in the demand over time might make it possible to operate the proposed unit more in the combined cycle mode and less in the pure gas turbine mode. This shift would provide savings in fuel combustion and air pollutants emitted.

In summary, we regard <u>economic actions</u> to be major available non-structural alternatives to various aspects of the construction and operation of generating plants. We expect to see such non-structural alternatives comprehensively explored in the EIS.

<u>Responses</u>

Applicant's Rate Schedules:

There are attached as Exhibits 8-1 through 8-15, copies of the Applicant's

basic electric rate schedules covering about 90 percent of its total business. Those schedules that are not attached include street lighting, which has no elesticity in regard to peak demand, and certain other schedules that are closed or restricted (i.e., no additional customers are eligible for these). In addition, there are attached general riders to the rate schedules that provide for fuel adjustment and tax adjustment surcharges as additions to the basic rate charges of the various classes of service.

The services provided by the Applicant, in 1972, to various classes of customers (FPC classification) were as follows:

Table 8-1

Class of Service	Sales 10^6 kwh	% of total sales	Avg. Rev. cents/kwh
Residential:			
all electrical homes	453	5.1	1.83
other	2124	24.1	3.05
Commercial	1729	19.6	2.63
Industrial	3848	43.7	1.51
Street lighting	40	0.5	-
Sales for resale	620	7.0	0.94
TOTAL	8814	100.0	2.10

Before determining the on-peak and off-peak rates for various classes of service, as required by this question, it is necessary to point out the following facts concerning the several rate schedules.

a. The Applicant is now awaiting decision from the Pennsylvania PUC on its request for approval of new rate schedules which would, among other things:

   1. Result in a general increase in its basic retail rates of about 24 percent.

   2. Close Rate 12 (Exhibit 8-2) for the all-electric customer and merge this schedule with Rate 11 (Exhibit 8-1) (i.e., there would be one single schedule for all residential customers).

   3. Increase demand charges by a greater percentage than that applied to energy charges.

b. It is not possible to compute on-peak and off-peak rates for residential and commercial customers, because of the absence of a demand charge for practically all customers served under Rates 11, 12, and 21. (Exhibits 8-1, 8-2,and 8-3).

c. It is possible to compute on-peak and off-peak rates for other services, and this has been done, with results summarized below.

d. The several rate schedules have the following features that provide incentive for off-peak use of power:

1. There are block rates, decreasing in price with increasing hours' use of demand, in Rates 31, 41, 42 (Exhibits 8-4, 8-5, and 8-6) and for resale service.

2. There are separate rates for off-peak water heating in Rates 21 and 31.

3. There are general provisions for off-peak demands in Schedules 31, 41, and 42. The on-peak period is defined as 12 hours on each weekday (except certain holidays); and demands established outside of the on-peak period are permitted to exceed the on-peak demands. Under Rates 31 and 41, the billing demand is either the maximum demand during on-peak periods or only 50 percent of the maximum demand occurring during off-peak periods. For Rate 42, this 50 percent factor is changed to 60 percent.

4. There is a further reduction (or credit) for off-peak energy use by Rate 41 customers with over 3 MW of demand and for all Rate 42 customers.

It is generally the desire of any utility to improve its load factor by developing off-peak use of energy, and the Applicant has had some success in so doing, as evidenced by its present load characteristics (see page 8-24). This is due in large part to the fact that it serves a large industrial load and that about 45 percent of its total supply is to customers who can take advantage of off-peak energy use. The several incentives to such use, that are briefly described in 4 above, have been available for at least seven years for Rate 42, and for much longer periods as related to Rates 31 and 41. That they can be substantial is evident in the following comparison of on-peak and off-peak rates.

In making this comparison, it is assumed that the on-peak period is of 12 hours' duration on each weekday (except certain holidays), and that all other hours are off-peak. This criterion of on-peak use has been selected for two reasons: (1) it corresponds to the provisions of Applicant's rate schedule, and (2) it corresponds to the expected use of the proposed combined cycle unit at Lake City. The 12-hour on-peak period is "intermediate" rather than a strictly peak use of service. However, if rates are computed for shorter periods of peak use, they would always be higher than those determined for 12 hours. This is because the energy blocks provide for lower rates with increasing hours of use; and at the same time the demand charges are spread over additional amounts of energy use.

Subject to the above introductory statements and to details of computation shown in Exhibit 8-7, the following on-peak and off-peak rates have been computed for typical customers served under the several rate schedules (except residential and commercial customers). The reported rates include the fuel and tax surcharges applicable to May 1973 billing, but not the increase in rates that is now pending before the Pennsylvania PUC. (Exhibits 8-8, 8-9, and 8-10).

	costs for additional use	
	on-peak rate mills/kwh	off-peak rate mills/kwh
Rate 31 (mostly small industry)	28.6	12.3
41 (industrial)	21.0	10.6
42 (very large industrial)	15.2	7.6
RP (resale customers) [Exhibits 8-11 to 8-15]	21.0	7.3

ELASTICITY

Very few quantitative data are available on elasticity of demand. Expert witnesses have testified for the Applicant in recent rate cases that there is relatively little elasticity in either the residential or commercial demands. While this testimony is related to total usage, it is probably equally true as to the daily patterns of use. Because the cost of electric service is a relatively small part of the total cost of living or of commercial business, potential savings from off-peak use of services are not likely to modify long established living habits.

The same situation does no hold for industrial use of power. Because of the frequent importance of power cost in industrial use, this use does exhibit some elasticity with respect to both total usage and daily patterns of use. As is evident from the description of the Applicant's rates, it has been for some time attempting to take advantage of this elasticity by promoting off-peak use of its services. So long as the rate differences indicated above are maintained (or increased, as provided for in a pending rate increase application), elasticity, to whatever extent it is present, will work toward a leveling of total system demand.

COMPARISON OF PRICES WITH MARGINAL COSTS

The charges for on-peak energy (including demand charges) are as shown above for the several classes of customers. The marginal cost of generation, as related to the proposed plant at Lake City, is shown in the draft environmental statement, Figure 5-2, in terms of $/kw/yr. for various hours of operation. These data can be converted into mills/kwh for use of this energy source.

hours of use	$/kw/year	mills/kwh
3000	57	19.0
4000	66.5	16.6
5000	76	15.2

Expected use of the combined cycle plant will be in the range of 3000 to 4000 hours per year, for which a typical cost will be about 18 mills per kwh. This is less than the charge for on-peak service under Rates 31, 41, and RP and not less under Rate 42.

In making this comparison, it should be kept in mind that the following factors have not been evaluated:

1. To provide reliable service requires reserve capacity, and if a 20 percent reserve is recognized, the above costs should be increased by about 2 mills (20 percent applied only to the fixed component of cost).

2. Offsetting this, however, is the diversity among customer demands, which permits 1 unit of capacity (plus reserve) to serve about 1.5 units of customer demand (coincidence factor of 67 percent). This reduces the fixed component of cost by about 3 mills.

3. The rates shown in Table 8-1 are necessarily based on the existing costs of providing service and present costs are now uniformly less than long-run marginal costs. Under these conditions, the supply of additional service will almost always result in increased costs of service and lead to higher rates.

4. The rates shown in Table 8-1 are those presently in effect. The costs for Lake City generation are estimated for 1974 and reflect escalation of equipment and fuel costs. For comparability the rates shown in Table 8-1 should also be increased (pending increase is based on a request for 24 percent).

5. The costs computed here for Lake City include no allowance for transmission losses, which might amount to about 5 percent for large customers served at transmission or subtransmission voltage and up to 10 percent for smaller customers at distribution voltages (an average increase of say 1.5 mills).

6. The costs computed here for Lake City include no allowance for additions to the transmission and distribution system, which are minimal as related to Lake City.

The net of factors 1, 2, 5, and 6, above, is an increase in cost for service from Lake City of less than 1 mill per kwh, which is likely to be more than offset by required increases in rates (factor 4). Therefore, it appears that the rates to be charged will not be out of line with the costs of providing additional services. To the extent there are deficiencies in present rates, the Applicant is moving to eliminate them.

Applicant's Load Characteristics

Although Applicant regularly establishes its annual peak during the winter season, it operates as part of a system (GPU) and pool (PJM) which have summer peaks. Capacity is planned in PJM to cover the summer peak with about 20 percent reserve. Because of the summer peak, new capacity is normally planned to be in-service during the spring; and obligations for capacity are considered to extend from June of one year through May of the following year.

The GPU system has a relatively flat load shape because it is comprised of companies with distinct differences in their seasonal load pattern. The Applicant has a distinct winter peak. Its affiliated company in Pennsylvania, Metropolitan Edison Company, has a winter peak followed by a summer peak of approximately the same magnitude. The Jersey component of the system has a distinct summer peak. When advantage is taken of this diversity, the GPU System operates with relatively little seasonal variation in its peak loads. From June through May of the following year, the average of the 52 weekly peaks is normally about 92 percent of the annual summer peak. In fact, this condition leaves an inadequate valley in the GPU load for its necessary maintenance. Maintenance is accomplished, however, by coordination within PJM, where there is generally a greater seasonal variation in load and adequate space for maintenance outages of generating equipment.

The result of this condition is that, so far as capacity responsibility is concerned, every week in the year is equally important to GPU and to the Applicant. Further leveling of Applicant's loads on a seasonal basis, would be of no advantage and result in no reduction of its contractual obligation for installed capacity. This means that any advantage of load leveling must be found on a weekly or daily basis, this being the condition to which the above mentioned features of Applicant's rates are directed.

That the Applicant has achieved some success in improving its load factor is evidenced by the following statistics. These relate to the 12 months from June of 1971 through May of 1972. Comparable data are also shown for GPU.

	Penelec	GPU
1. Annual load factor = (12 mo. net system require./annual peak)	66.0%	68.5%
2. Average weekly load factor = (12 mo. net system require./average weekly peak)	75.4	75.4
3. Average daily load factor = (12 mo. net system require./average daily peak)	83.7	83.4

In recent years, and expected in the future, this practice of loading generation on a cost basis is also expected to require Lake City operation for about 3000 hours, or more, per year. The important point is that, during all these hours of operation, the Lake City combined cycle unit is displacing other generation that has a higher cost.

If Lake City were not available to provide the service expected of it, the required energy generation would be provided by combustion turbines or old and inefficient fossil-fired steam units. This is the natural result of loading the available generation on a cost basis. All the less costly generation is utilized before Lake City is called upon, so that, if Lake City were not available, only more costly generation would still be available for its replacement. More costly generation generally means less efficient use of oil in combustion turbines or of coal and oil in older steam units. This in turn means more air pollution and greater heat release to streams, lakes, or the atmosphere.

It is expected that the planned use of the Lake City combined cycle unit will result in fuel savings, as compared to the necessary alternative use of other

units, as well as minimize the discharge of waste heat and of air pollution.

The applicant is required by law to provide electric power as demanded by their customers and this plant is required to keep up with the demand.

Comment

Safety - from page 4:

Weakening of the ice by heated water might possible cause a safety hazard to fishermen exploiting the attraction of fish to the heated plume in winter. What safety precautions would be exercised by the applicant?

Response

The applicant will monitor the ice around the discharge area during its winter operation. Should it discover soft or thin ice, appropriate warnings including notice in newspapers will be given.

Comment

Monitoring - from page 4:

The final EIS should indicate what provisions will be made to monitor:

1. The thermal plume, especially if stagnation occurs,
2. Potential fishkills resulting from entrapment and other entrainment losses,
3. Discharges of oil or other chemicals, deliberate or accidental. (If biocides are used to control fouling, will these toxic materials be present in the discharges?)

Response

The applicants monitoring plans consist of the following:

1. The performance evaluation of the thermal diffuser was calculated using a mathematical dispersion model. From this the proportions of the plumes were determined. Through the first year of operation periodic temperature surveys will be made in the lake to check the results of the model. Lake inlet water temperature, lake return water temperature, and flow will be monitored continuously. Having the pattern of the plume from existing surveys, the proportions of the plume at any time will be determinable from the above monitored variables.
2. Periodic inspection will be made in the refuge area at the pump chamber, at the cooling tower basin, and in the condenser water boxes.
3. No biocides will be used in plant operation. With regard to accidental oil and other chemical discharges, monitoring of wastes will, at a minimum, be done by manual inspection of the discharge facilities. There will be two discharges only that will not be manually actuated: first, the floor drains from the plant, for which an adequate sized oil separater will be

provided; secondly, the filtrate from the sludge dewatering beds. Even if there is a plant malfunction, this design will prevent the oil and chemical discharges to the lake.

Comment

Oil Spill Prevention, Containment and Countermeasure Plan - from page 4:

The statement should expand its Spill Prevention, Containment and Countermeasure (SPCC) Plan if that is what Itmes C1.3, C1.3.1, C1.3.2 and C1.3.3 in appendix "C" are intended to be. These items are inadequate from the standpoint of EPA's standards and may not fulfill Pennsylvania's requirements for a Pollution Incident Prevention Plan. This facility will receive No. 2 fuel oil by either tank truck or tank car, and also use sulfuric acid, sodium hydroxide, ammonia and possibly PCB in their transformers. Spills of any of these materials could certainly harm the receiving waters and we believe Pennsylvania Electric should supply a comprehensive plan. Such a plan shall include information and procedures relative to the prevention of spills and hazardous substances including:

a) A description of the reporting system which will be used to alert responsible facility management and appropriate legal authorities.

b) A description of preventive facilities (including overall facility plot) which prevent, contain or treat spills and unplanned discharges.

c) A list of all oil and hazardous materials used, processed or stored at the facility which may be permitted into the permitted discharge.

Response

The Department of Environmental Resources has issued a Water Quality Management Permit (Permit #2572205) in response to an application by PENELEC which was accompanied by a "Pollution Incident Prevention Program" a copy of which is on record with the State of Pennsylvania. A copy of this was transmitted to the EPA.

Comments

Licenses & Permits Required - from page 4:

Proposed effluent conditions submitted apparently meet both Federal and State requirements. However, this project will require an EPA discharge permit under Section 402 of P.L. 92-500 and state certification under Section 401 of this law, as well as a Section 10 Permit for work in navigable waters.

Response

A discharge permit was issued by the EPA on 22 July 1973 for this project.

Comment

Dredging and Blasting Impact - from page 5:

It is noted that damage to fish eggs and fry can be avoided by dredging when spawning of important fish species does not take place in the project vicinity. The specifics of the schedule should be described in the final EIS. Since a significant amount of excavation will be done utilizing explosives, we recommend coordination of this aspect with appropriate Federal and State Fish and Game Agencies.

Response

A literature search revealed the expected spawning seasons for the fish species common to Lake Erie cover the period from March to November. The fish sampling program to be conducted will provide data on spawning which will be a basis for determining the dredging schedule. Federal and Local Fish and Game Agencies will be contacted to coordinate this work.

Comment

Septic Tank Design - from page 5:

It is stated that raw sewage from the plant is collected in a septic tank; however, no information is given on its design or the possibility of its seepage into the two bodies of water adjacent to the plant.

Response

The system was designed in cooperation with the Director of the Division of Sanitary Engineering, Erie County Department of Health, whose recommendations and construction procedures will be followed. The field area will be at least the 2,000 sq. ft. he recommended as being satisfactory for the Conotton soil of the site. Precautions will be taken to ensure the suitability of the virgin soil beneath the 2-B Stone leach field. In the event it is unsuitable, all the materials within the 16 feet depth will be excavated and replaced with suitable material.

Comment

Editorial - from page 5:

We have reported this review in EPA Reporting Category ER-2, i.e., EPA has reservations concerning the environmental effects of certian aspects of the proposed action and believes that the draft does not contain sufficient information to assess fully the environmental impact of the proposed project. The classification and date of EPA's comments will be published in the Federal Register in accordance with our responsibility to inform the public of our views on proposed actions under Section 309 of the Clean Air Act.

Response

Revised Appendix A and the new Appendices D and E add additional data on the impact of this plant on the air quality of the area.

RATE 11

DOMESTIC SERVICE

AVAILABILITY:

Available in the entire territory of the Company to customers using the Company's standard service for residential lighting, appliance operation, cooking and general household purposes.

CHARACTER OF SERVICE:

Alternating current, 60 cycles; supplied at 120/240 volts, single phase, in the entire service area except in network areas where only 120/208 volts is available.

RATE (Per Month): (I) (C)

				Net	Gross	
First	15	kwh or less		$1.20	$1.32	
Next	30	kwh	@	6.00¢	6.60¢	per kwh
Next	55	kwh	@	4.10¢	4.51¢	per kwh
Next	400	kwh	@	2.40¢	2.43¢	per kwh
Next	500	kwh	@	1.80¢	1.80¢	per kwh
All over	1000	kwh	@	1.50¢	1.50¢	per kwh

MINIMUM CHARGE:

The minimum monthly charge shall be $1.20 net ($1.32 gross) but not less than any monthly guarantee established under Rule 19--Extension of Company's Facilities. (I)

RIDERS: (C)

Bills rendered under this rate schedule are subject to the charges stated in any applicable Rider.

PAYMENT TERMS:

The Company's standard payment terms shall apply to all bills rendered under this rate. Upon payment of bill within fifteen days from date of billing, the net rate shall apply; otherwise the gross rate shall determine the bill.

SPECIAL PROVISIONS:

(a) Service for automatic storage water heaters of a capacity, design and type approved by the Company and installed in accordance with its specifications, in regular use for the customer's total running hot water requirements will be included with the total use and billed under this schedule in the following manner: First 100 kwh in accordance with the first three blocks of the above rate; next 200 kwh at 2.40¢ per kwh net (2.43¢ per kwh gross); next 400 kwh at 1.30¢ per kwh; next 400 kwh--50% at 1.30¢ per kwh and 50% at 2.4¢ per kwh net (2.43¢ per kwh gross); next 500 kwh at 1.8¢ per kwh; and all over 1600 kwh at 1.50¢ per kwh. This provision is subject to modification in accordance with Special Provision (c). (I) (C)

Heating elements shall be non-inductive and shall be controlled by individual thermostatic switches. Two-element heaters shall be equipped with a double throw switch which will prevent the simultaneous operation of the elements. The rating of the upper and the lower heating elements shall not exceed 5,500 watts each. The minimum tank capacity shall be 40 gallons. (C)

The Company reserves the right to install meters and time clock devices on the customer's wiring and limit the energy billed at 1.3¢ to off-peak hours which may be specified from time to time by the Company. (I) (C)

(b) Combined Service: Where a customer conducts a business in the same premises as his residence and the combined energy requirements are measured by a single meter, the energy so used shall be billed at the above rate, provided that the connected load in lighting and power used for business or commercial purposes does not exceed 2,000 watts. Where the commercial portion of the total load is in excess of 2,000 watts, separate meters must be installed for the residential and for the commercial requirements, or the combined service shall be billed under the terms and provisions of RATE 21 GENERAL SERVICE—SMALL

(c) Multiple Dwellings: Service to a maximum of 5 dwelling units in a single structure may, at the Company's option, be supplied through a single meter. When such multiple dwellings are supplied through a single meter the charge and size of the first block, the size of the remaining blocks and the minimum charge of the above rate shall be increased in direct proportion to the number of apartments and/or single dwelling units served. Where automatic storage water heaters are used in multiple dwellings, in accordance with Special Provision (a), the number of kilowatthours billed at the water heating rate shall be determined by the number of water heaters served. Customers may elect to take off-peak water heating service under Special Provision (a) of RATE 21 GENERAL SERVICE—SMALL.

(d) Loads in Excess of 20 Kilowatts: The Company shall install a suitable demand meter to determine the maximum 15-minute integrated demand when customer's service requires the installation of an individual transformer of a capacity in excess of 20 kilovolt-amperes, or the monthly usage exceeds 6,000 kilowatthours for two consecutive months.

If the demand so determined under this provision exceeds 20 kilowatts a monthly demand charge of $1.20 per kw shall apply to such excess, in addition to the energy charge. The demand charge in no event shall be less than 50% of the highest demand charge during the preceding eleven months. (I)

(I) Increase
(C) Change

PENNSYLVANIA ELECTRIC COMPANY

RATE 12

DOMESTIC SERVICE—HOUSE HEATING

AVAILABILITY:

Available in the entire territory of the Company to customers using the Company's standard service for residential lighting, appliance operation, cooking, general household purposes, and as the sole primary method of space heating and water heating. Space heating installations must be approved by the Company.

CHARACTER OF SERVICE:

Alternating current, 60 cycles; supplied at 120/240 volts, single phase, in the entire service area except in network areas where only 120/208 volt service is available.

NET RATE (Per Month): (I) (C)

First	100 kwh or less	@	$5.25	
Next	200 kwh	@	2.40¢	per kwh
Next	400 kwh	@	1.30¢	per kwh
Next	300 kwh	@	1.80¢	per kwh
All over	1000 kwh	@	1.20¢	per kwh

MINIMUM CHARGE: (I)

The minimum charge shall be $5.25 per month, for which customer is entitled to use 100 kwh.

RIDERS: (C)

Bills rendered under this rate schedule are subject to the charges stated in any applicable Rider.

PAYMENT TERMS:

The Company's standard payment terms shall apply to all bills rendered under this rate. Customer shall have the option of budget billing. If budget billing is requested, customer's annual billing will be estimated, and a bill will be rendered monthly for one-twelfth of such estimated annual bill. Any adjustment necessary in applying for the full annual period the actual charges herein established will be made in the final bill for the annual period.

SPECIAL PROVISION:

(a) Loads in Excess of 25 Kilowatts: When customer's 15-minute integrated demand has exceeded 25 kw in either the current month or the preceding eleven months, a demand charge of $0.60 per kw based upon the maximum excess demand over 25 kw in the current month or eleven preceding months shall be added to the monthly energy charge. (I)

(I) Increase
(C) Change

RATE 21

GENERAL SERVICE—SMALL

AVAILABILITY:

Available in the entire territory of the Company to customers using the Company's standard service for general light and power purposes not included within the availability of RATE 11 DOMESTIC SERVICE, with Billing Demands not in excess of 10 kw. When the Billing Demand in two consecutive months exceeds 10 kw, the customer shall be transferred to RATE 31 GENERAL SERVICE—MEDIUM for a minimum period of twelve months.

CHARACTER OF SERVICE:

Alternating current, 60 cycles; supplied at 120/240 volts, single phase; and 240 volts polyphase in the entire service area except in network areas where only 120/208 volts is available.

RATE (Per Month):

Demand Charge (I)

		Net	Gross	
First 5 kw of demand		No Charge		
Additional kw of demand	@	$2.40	$2.64	per kw

Energy Charge (I) (C)

			Net	Gross	
First	15 kwh or less		$1.20	$1.32	
Next	30 kwh	@	6.00¢	6.60¢	per kwh
Next	305 kwh	@	5.02¢	5.52¢	per kwh
Next	350 kwh	@	3.73¢	4.10¢	per kwh
Next	800 kwh	@	2.30¢	2.30¢	per kwh
All over 1,500 kwh		@	1.65¢	1.65¢	per kwh

Maximum Charge (I) (C)

No bill shall be rendered in an amount greater than $240 plus 5.4¢ per kwh, except by reason of the minimum monthly charge.

DETERMINATION OF BILLING DEMAND:

The Company shall install suitable demand meters to determine the maximum 15-minute integrated demand when customer's total monthly consumption exceeds 1,000 kilowatthours for two consecutive months. The billing demand shall be the sum of the individual demands of each metered service. The individual demand of each metered service shall be determined separately. Service rendered under Special Provision (f) shall be excluded herefrom.

MINIMUM CHARGE:

The minimum monthly charge shall be $1.20 net ($1.32 gross) for the first 5 kw, or less, of billing demand; for billing demands in excess of 5 kw it shall be the demand charge, based on the highest billing demand established during the current month or the preceding eleven months. (I)

In no event shall the minimum charge be less than any monthly guarantee established under Rule 19—Extension of Company's Facilities.

RIDERS: (C)

Bills rendered under this rate schedule are subject to the charges stated in any applicable Rider.

PAYMENT TERMS:

The Company's standard payment terms shall apply to all bills rendered under this rate. Upon payment of bill within fifteen days from date of billing, the net rate shall apply; otherwise, the gross rate shall determine the bill.

TERM OF CONTRACT:

Contract for installations of a permanent nature shall be written for a period of not less than one year. A separate contract shall be written for each location.

(Rate continued on reverse side)

(I) Increase
(C) Change

RATE 21—Continued

SPECIAL PROVISIONS:

(a) Off-Peak Water Heating Service: Off-peak service will be rendered for automatic storage water heaters in regular use for the total running hot water requirements of the customer's premises. Heaters shall be of a capacity, design and type approved by the Company and installed in accordance with its specifications. The heating elements shall be non-inductive with no individual element requiring more than 33 watts per gallon of storage tank capacity.

The Company shall install a meter and time control device on the customer's wiring to measure the energy used off-peak. The rate for such off-peak energy shall be 1.3¢ per kilowatthour, subject to a minimum monthly charge of $1.20 per installation. (I) (C)

Off-peak service shall be rendered for not less than ten consecutive hours per day. Off-peak periods shall be specified from time to time by the Company.

(b) Temporary Service: Service of a temporary nature will be rendered at the charges set forth herein, provided that the customer reimburses the Company for all costs of installing and removing the service installation, including costs of poles, conductors, transformers, meters and other equipment, together with all labor and other expenses incurred, less the salvage recovered from all materials and equipment removed after termination of service. Service will not be connected until the customer has made an advance payment equal to the estimated charges for installation and removal of service.

(c) Service to Schools: Service to public schools and parochial schools will be rendered at the charges set forth herein, provided that the minimum monthly charge may be waived during three consecutive months of each calendar year. Any kilowatthours used during the period of waiver will be included in subsequent billing.

(d) Direct Current Service: Direct current service is restricted solely to present loads and locations of customers receiving such service as of the effective date of this tariff. Where direct current service is supplied, all charges shall be increased ten per cent.

(e) Combined Billing: Combined billing will not be permitted except where customers are supplied with single phase and polyphase service at secondary voltages at a single location. In such instances, only one single phase and one polyphase service may be combined for billing purposes.

(f) Space Heating Service: Upon request, space heating service may be supplied through a separate metered circuit for customers utilizing electricity as the primary method of space heating. Air conditioning and cooking equipment may also be connected to the heating circuit. All energy supplied hereunder shall be billed at the rate of 1.75¢ per kilowatthour. Service rendered under this provision shall have no effect on the application of other charges and provisions of the rate schedule to customer's other service. (I) (C)

(g) Service to Churches: Service to churches and adjacent buildings which are operated in conjunction therewith (other than schools, residences, and camp sites) will be rendered at the charges set forth herein, provided that the billing demand shall be taken as 5 kw. The minimum monthly charge may be waived during three consecutive months of each calendar year. Any kilowatthours used during the period of waiver will be included in subsequent billing.

(I) Increase
(C) Change

EXHIBIT 8-3a

RATE 21

GENERAL SERVICE--MEDIUM

AVAILABILITY:

Available in the entire territory of the Company to commercial and industrial customers with billing demands in excess of 10 kw.

CHARACTER OF SERVICE:

Alternating current, 60 cycles; supplied at 120/240 volts, single phase; and 240 volts polyphase in the entire service area except in network areas where only 120/208 volts is available. At the option of the Company, three phase service may be made available in other than network areas at 480 volts for power service or at 120/208 volts where lighting demands exceed 75 kilowatts.

NET RATE (Per Month):

Demand Charge (I)

First 10 kw of billing demand (not less than 10 kw)	@	$2.40	per kw
Next 40 kw of billing demand	@	2.15	per kw
Over 50 kw of billing demand	@	1.80	per kw

Energy Charge (I) (C)

First 4,000 kwh	@	2.35¢	per kwh
Next 6,000 kwh	@	1.92¢	per kwh
Over 10,000 kwh	@	1.58¢	per kwh
Over 200 hours' use of billing demand	@	0.93¢	per kwh
Over 400 hours' use of billing demand and over 10,000 kwh	@	0.77¢	per kwh

Maximum Charge (I) (C)

No bill shall be rendered in an amount greater than $2.40 plus 5.4¢ per kilowatthour except by reason of the minimum monthly charge.

MINIMUM MONTHLY CHARGE:

The kilowatt demand charge for one-half of the billing demand, but in no event computed on less than one-half of the highest kilowatt demand billed during the preceding eleven months.

RIDERS: (C)

Bills rendered under this rate schedule are subject to the charges stated in any applicable Rider.

PAYMENT TERMS:

The Company's standard payment terms shall apply to all bills rendered under this rate. Upon payment of bill within fifteen days from date of billing, the above net rate shall apply; otherwise, the net rate plus a delayed payment charge of 2% is due and payable.

TERM OF CONTRACT:

Not less than one year. A separate contract shall be written for each location.

(Rate continued on reverse side)

(I) Increase
(C) Change

RATE 31—Continued

SPECIAL PROVISIONS:

(a) Off-Peak Water Heating Service: Off-peak service will be rendered for automatic storage water heaters in regular use for the total running hot water requirements of the customer's premises. Heaters shall be of a capacity, design and type approved by the Company and installed in accordance with its specifications. The heating elements shall be non-inductive with no individual element requiring more than 33 watts per gallon of storage tank capacity.

The Company shall install a meter and time control device on the customer's wiring to measure the energy used off-peak. The rate for such off-peak energy shall be 1.3¢ per kilowatthour, subject to a minimum monthly charge of $1.20 per installation. (I) (C)

Off-peak service shall be rendered for not less than ten consecutive hours per day. Off-peak periods shall be specified from time to time by the Company.

(b) Temporary Service: Service of a temporary nature will be rendered at the charges set forth herein, provided that the customer reimburses the Company for all costs of installing and removing the service installation, including costs of poles, conductors, transformers, meters and other equipment, together with all labor and other expenses incurred, less the salvage recovered from all materials and equipment removed after termination of service. Service will not be connected until the customer has made an advance payment equal to the estimated charges for installation and removal of service.

(c) Service to Schools: Service to public schools and parochial schools will be rendered at the charges set forth herein, provided that the minimum monthly charge may be waived during three consecutive months of each calendar year. Any kilowatthours used during the period of waiver will be included in subsequent billing.

(d) Untransformed Service: When service is supplied at primary or transmission voltages, and the customer furnishes all necessary transformer and terminal equipment, the active kilowatt demand charge per month shall be decreased in accordance with the following adjustment table: (C)

Voltages	Adjustment Per KW of Billing Demand
2,400 to 4,200	15¢
4,300 to 15,000	25¢
Over 15,000	35¢

The above adjustments shall not apply to bills computed under the maximum charge provision, nor to the minimum monthly charge.

(e) Off-Peak Service: When a customer with a registered demand in excess of 50 kilowatts normally creates a greater demand during off-peak hours, the demand for billing purposes shall be the maximum demand during the on-peak period. The billing demand in no case shall be taken at less than 50% of the maximum demand created at any time during the month. The off-peak period shall be from 8:00 P.M. to 8:00 A.M., Monday through Friday, and the entire day on Saturdays, Sundays, and holidays. The following holidays shall be considered as off-peak days: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day.

The Company reserves the right to change the off-peak hours specified above in accordance with the operating conditions on the Company's system.

(f) Direct Current Service: Direct current service is restricted solely to present loads and locations of customers receiving such service as of the effective date of this tariff. Where direct current service is supplied, the demand, energy, maximum and minimum charges shall be increased ten per cent.

(g) Combined Billing: Combined billing will not be permitted except where customers are supplied with single phase and polyphase service at secondary voltages at a single location. In such instances, only one single phase and one polyphase service may be combined for billing purposes.

(h) Space Heating Service: Upon request, space heating service may be supplied through a separate metered circuit for customers utilizing electricity as the primary method of space heating. Air conditioning and cooking equipment may also be connected to the heating circuit. All energy supplied hereunder shall be billed at the rate of 1.75¢ per kilowatthour. Service rendered under this provision shall have no effect on the application of other charges and provisions of the rate schedule to customer's other service. (I) (C)

(I) Increase
(C) Change

EXHIBIT 8-4c

PENNSYLVANIA ELECTRIC COMPANY

RATE 41

GENERAL SERVICE—LARGE

AVAILABILITY:

Available in the entire territory of the Company to commercial and industrial customers with billing demands of not less than 100 kw.

CHARACTER OF SERVICE:

Alternating current, 60 cycles; supplied at 240 volts polyphase in the entire service area except in network areas where only 120/208 volts or 277/480 volts is available. At the option of the Company, three phase service may be made available in other than network areas at 120/208 volts, 480 volts or 277/480 volts.

NET RATE (Per Month):

Demand Charge (I) (D) (C)

Active (Kilowatts)

First 200 kw of demand	@	$1.95 per kw
Next 800 kw of demand	@	1.65 per kw
Over 1,000 kw of demand	@	1.40 per kw

Reactive (Kilovars)

Maximum registered reactive demand (kvars) in excess of one-third of the kilowatt billing demand	@	15.0¢ per kvar

Energy Charge (I) (C)

First 20,000 kwh	@	1.92¢ per kwh
Next 30,000 kwh	@	1.58¢ per kwh
Next 50,000 kwh	@	1.18¢ per kwh
Next 200,000 kwh	@	0.93¢ per kwh
Over 300,000 kwh	@	0.87¢ per kwh
Over 200 hours' use of billing demand	@	0.77¢ per kwh
Over 400 hours' use of billing demand	@	0.63¢ per kwh
Over 500 hours' use of billing demand	@	0.53¢ per kwh

Maximum Charge (I) (C)

No bill shall be rendered in an amount greater than 4.5¢ per kilowatthour, except by reason of the minimum monthly charge.

MINIMUM MONTHLY CHARGE:

The kilowatt demand charge for one-half of the billing demand, but in no event computed on less than one-half of the highest kilowatt demand billed during the preceding eleven months, nor less than 100 kilowatts.

RIDERS: (C)

Bills rendered under this rate schedule are subject to the charges stated in any applicable Rider.

PAYMENT TERMS:

The Company's standard payment terms shall apply to all bills rendered under this rate. Upon payment of bill within fifteen days from date of billing, the above net rate shall apply; otherwise, the net rate plus a delayed payment charge of 1% is due and payable.

TERM OF CONTRACT:

Not less than one year.

(Rate continued on reverse side)

(I) Increase
(D) Decrease
(C) Change

Issued April 21, 1971 — Effective March 29, 1971

EXHIBIT 8-5

RATE 41—Continued

SPECIAL PROVISIONS:

(a) Temporary Service: Service of a temporary nature will be rendered at the charges set forth herein, provided that the customer reimburses the Company for all costs of installing and removing the service installation, including costs of poles, conductors, transformers, meters and other equipment, together with all labor and other expenses incurred, less the salvage recovered from all materials and equipment removed after termination of service. Service will not be connected until the customer has made an advance payment equal to the estimated charges for installation and removal of service.

(b) Service to Schools: Service to public schools and parochial schools will be rendered at the charges set forth herein, provided that the minimum monthly charge may be waived during three consecutive months of each calendar year. Any kilowatthours used during the period of waiver will be included in subsequent billing.

(c) Untransformed Service: When service is supplied at primary or transmission voltages, and the customer furnishes all necessary transformer and terminal equipment, the active kilowatt demand charge per month shall be decreased in accordance with the following adjustment table: (C)

Voltages	Adjustment Per KW of Billing Demand
2,400 to 4,200	15¢
4,300 to 15,000	25¢
Over 15,000	35¢

The above adjustments shall not apply to bills computed under the maximum charge provision, nor to the minimum monthly charge.

(d) Off-Peak Service: When the maximum active demand is created during off-peak hours, the active demand for billing purposes shall be the maximum active demand during the on-peak period. The active billing demand in no case shall be less than 50% of the maximum active demand created at any time during the month. The off-peak period shall be from 8:00 P.M. to 8:00 A.M., Monday through Friday, and the entire day on Saturdays, Sundays, and holidays. The following holidays shall be considered as off-peak days: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day. (C)

When a customer's billing demand exceeds 3,000 kilowatts, a credit adjustment of 0.086¢ per kilowatthour shall apply to the off-peak kilowatthours. (D) (C)

The Company reserves the right to change the off-peak hours specified above in accordance with the operating conditions on the Company's system.

(e) Multi-point Delivery: Where the load of an industrial customer located on single or contiguous premises becomes greater than the capacity of the standard circuit or circuits established by the Company to supply the customer, additional delivery points may be established for such premises upon written request of the customer, provided multi-point delivery is not disadvantageous to the Company. When such additional points of delivery are established billing shall be based on the sum of the meter readings.

(f) Space Heating Service: Upon request, space heating service may be supplied through a separate metered circuit for customers utilizing electricity as the primary method of space heating. Air conditioning and cooking equipment may also be connected to the heating circuit. All energy supplied hereunder shall be billed at the rate of 1.75¢ per kilowatthour. Service rendered under this provision shall have no effect on the application of other charges and provisions of the rate schedule to customer's other service. (I) (C)

(I) Increase
(D) Decrease
(C) Change

RATE 42
WHOLESALE POWER

AVAILABILITY:

Available in the entire territory of the Company for industrial service to customers with billing demands of not less than 12,000 kw.

CHARACTER OF SERVICE:

Alternating current, 3 phase, 60 cycles, 23,000 volts or over.

NET RATE (Per Month):

Demand Charge (I) (D) (C)

Active (Kilowatts)

First 40,000 kw of billing demand	@	$1.36	per kw
Over 40,000 kw of billing demand	@	1.15	per kw

Reactive (Kilovars)

Maximum reigstered reactive demand (kvars) in excess of one-third of the kilowatt billing demand	@	15.0¢	per kvar

Energy Charge (I) (C)

First 300 kwh per kw of billing demand	@	0.718¢	per kwh
Next 200 kwh per kw of billing demand	@	0.541¢	per kwh
Over 500 kwh per kw of billing demand	@	0.429¢	per kwh

A credit adjustment of 0.054¢ per kilowatthour shall apply to the off-peak kilowatthours. (D) (C)

OFF-PEAK AND ON-PEAK PERIODS:

The on-peak hours shall be from 9:00 A.M. to 9:00 P.M. Monday through Friday, excluding holidays. All other hours shall be considered off-peak. The following holidays shall be considered as off-peak days: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day.

The Company reserves the right to change the on-peak hours and off-peak hours specified above in accordance with the operating conditions on the Company's system.

MINIMUM MONTHLY CHARGE:

The kilowatt demand charge based on 12,000 kilowatts or on one-half of the highest kilowatt demand billed during the preceding eleven months, whichever is greater.

DETERMINATION OF BILLING DEMAND:

The monthly billing demand shall be the highest of the following:

(1) The average of the maximum 15-minute integrated demands registered during on-peak hours in each of the four weekly periods during the month. The four weekly periods of the month shall be the initial partial day of the billing month plus seven full days, the second seven full days, the third seven full days, and the remaining days of the billing month.

(2) 60% of the maximum 15-minute integrated demand registered at any time during the month.

(3) 12,000 kw.

RIDERS: (C)

Bills rendered under this rate schedule are subject to the charges stated in any applicable Rider.

(Rate continued on reverse side)

(I) Increase
(D) Decrease
(C) Change

RATE 42—Continued

PAYMENT TERMS:

The Company's standard payment terms shall apply to all bills rendered under this rate. Upon payment of bill within fifteen days from date of billing, the above net rate shall apply; otherwise, the net rate plus a delayed payment charge of 1% is due and payable.

TERM OF CONTRACT:

The contract shall be written for a term of not less than five years, automatically renewable from year to year after the expiration of the original term, unless written notice of cancellation is given by one party to the other at least 90 days in advance of the expiration date.

SPECIAL PROVISIONS:

(a) Multi-point Delivery: Where the load of an industrial customer located on single or contiguous premises becomes greater than the capacity of the standard circuit or circuits established by the Company to supply the customer, additional delivery points may be established for such premises upon written request of the customer, provided multi-point delivery is not disadvantageous to the Company. When such additional points of delivery are established billing shall be based on the sum of the meter readings.

(b) 115,000 Volt Delivery: Upon request Company will furnish service at 115,000 volts where available, provided customer furnishes all necessary transformer and terminal equipment. When service is supplied at 115,000 volts the active kilowatt demand charge per month shall be decreased 15¢ per kw of billing demand. (C)

(c) Less than 23,000 Volt Delivery: At the option of the Company service may be rendered at less than 23,000 volts, but not less than 10,000 volts, provided that such delivery is not disadvantageous to the Company and can be made economically in a single transformation from available transmission lines of 115,000 volts or above.

(C) Change

Determination of On-Peak and Off-Peak Rates

Determination of on-peak and off-peak rates has been made for service supplied under General Service Rates 31, 41, and 42 and for Resale Power Service under FPC Rate RP. In total, these services constitute about 50% of the service supplied by Pennsylvania Electric Company. No determination of such rates has been made or can be made for residential and commercial customers (served under Rates 11, 12, and 21), because of the absence of demand.

In the context of the other questions that are asked by EPA we have understood the question "What prices are charged for peak and non-peak power...?" to mean what prices does the average customer pay for (a) additional on-peak use and (b) for additional off-peak use? The customers' decisions as to when they will make use of the Applicant's service and their resulting load patterns are determined by these marginal prices, rather than by any average costs.

The on-peak price is thecombined result of the following components:

(i) Demand charge, spread over the first 200 hours used in pricing the energy in (ii) (264 hours per month = 22 weekdays x 12 hours/day is the maximum number of on-peak hours per month).

(ii) All the energy costs associated with the first 200 hours use of incremental demand (i.e., no higher rates for fixed energy blocks are included in this rate).

(iii) Fuel cost adjustment (effective factor for April 1973).

(iv) Tax adjustment surcharge (effective April 1, 1973 for the retail rates.)

The off-peak price is the incremental block price for energy (essentially the retail rate) available for use of demand in excess of 400 or 500 hours per month, this being on the basis that the majority of customers have already achieved this usage. The off-peak price is then the sum of the following components:

(vi) The incremental energy block rate.

(vii) Credit (if any) for off-peak use.

(viii) Fuel cost adjustment.

(ix) Tax adjustment surcharge.

This off-peak price is available under Rates 31 and 41 until the off-peak demand is double the on-peak demand; for Rate 42, until the off-peak demand exceeds 1.67 times the on-peak demand. For Resale Service, the customer can add off-peak load only until the off-peak and on-peak demands are equal.

PENNSYLVANIA ELECTRIC COMPANY

RIDER A

TAX ADJUSTMENT SURCHARGE

Tax Adjustment Surcharge: A tax adjustment surcharge of 5.62% will be added to the billings calculated under the provisions of this tariff. This tax adjustment surcharge, issued in accordance with the permission granted by the Pa. P.U.C. in its State Tax Adjustment Procedure Order dated March 10, 1970, will be applied to all service rendered on and after April 1, 1973. (D)

The tax adjustment surcharge percentage, in accordance with the Pa. P.U.C. Order, will be recalculated:

a. Whenever any of the tax rates used in determining the surcharge percentage are changed;

b. Whenever the company's rates subject to the Commission's jurisdiction are increased or decreased;

c. On March 31, 1971, and each year thereafter.

The above-stated recalculations will be submitted to the Commission within ten days after the occurrence of the event or the date which occasions such recalculations; and if the recalculated surcharge is less than the one then in effect the company will, and if the recalculated surcharge is more than the one in effect the company may, submit with the recalculation a tariff or supplement which reflects the recalculated surcharge, the effective date of which shall be ten days after its filing with the Commission and which shall apply to service rendered on or after the effective date.

(D) Decrease

RIDER B

FUEL COST ADJUSTMENT (I) (C)

A fuel cost adjustment shall be applied to each kilowatthour supplied under this tariff. This fuel cost adjustment, determined to the nearest 0.01 mill in accordance with the formula set forth below, shall be applied to all kilowatthours supplied during the billing period.

$$A = (C - B) \times \frac{F}{I} \times \frac{I}{S} \times \frac{1}{1 - T}$$

Where A = Adjustment in mills per kilowatthour to be applied to each kilowatthour supplied under this tariff.

C = The current fuel cost in mills per kilowatthour net generation in Company's fossil-fuel-fired generating stations, determined by dividing the month's total of Accounts 501 and 547 by the net generation produced by fossil fuels in that month.

B = Base fossil fuel cost of 2.522 mills per kilowatthour.

F = 12 months to date kilowatthour totals of:
fossil fuel net generation,
plus such of the gross interchange and purchased power received as varies in price with the cost of fossil fuel, and
minus such of the gross interchange and purchased power delivered as varies in price with the cost of fossil fuel.

I = 12 months to date kilowatthour totals of:
total system net generation from all sources,
plus interchange and purchased power received, and
minus interchange and purchased power delivered.

S = 12 months to date total kilowatthour sales.

T = The Pennsylvania gross receipts tax rate in effect during the billing month, expressed as a decimal.

The "C" factor is to be determined for the second calendar month preceding the billing month.

The "F", "I" and "S" factors are to be determined as the 12 months to date totals for the period ending with the second calendar month preceding the billing month.

The amount of fuel adjustment billed shall not be increased by the Tax Adjustment Surcharge (Rider A). Minimum bills shall not be reduced by reason of this fuel adjustment clause. This fuel adjustment clause shall be applied to all kilowatthours supplied, and such charge shall be in addition to any minimums applicable.

(I) Increase
(C) Change

Effective for service rendered
on and after January 16, 1971

EXHIBIT 8-9

Pennsylvania Electric Company

CALCULATION OF FUEL COST ADJUSTMENT - ELECTRIC

Applicable to All Rate Schedules in
Tariff Electric Pa. P.U.C. No. 58

PENNSYLVANIA CUSTOMERS

September 1973 Billing - Based on July 31, 1973 Data

TO ALL TARIFF HOLDERS:

Fuel Cost Adjustment 2.17 Mills per KWH*

Applicable to all rates in Tariff Electric Pa. P.U.C. No. 58

Fuel data for July 1973 on which September 1973 adjustment is based:

Factor A - Fuel Cost Adjustment	
Factor C - Current Fuel Cost	4.408 mills per kwh
Factor B - Base Fuel Cost	2.522 mills per kwh
Factor F/S - Fossil Fuel Generation/Sales	1.101302
Factor T - Gross Receipts Tax	0.045

Factor A - Fuel Cost Adjustment:

$$A = (C - B) \times \frac{F}{I} \times \frac{I}{S} \times \frac{1}{1 - T}$$

$$A = (4.408 - 2.522) \times 1.101302 \times \frac{1}{0.955}$$

$$A = 2.17 \text{ mills per kwh}$$

*In accordance with Executive Order No. 11723 of the President of the United States, issued June 13, 1973, and the statement of the Pennsylvania Public Utility Commission, dated June 25, 1973, the Fuel Cost Adjustment charge shall not exceed the 2.29 mills per kilowatthour charge in effect during the "freeze base period," June 1 to June 8, 1973.

G. Ballirano

G. Ballirano, Manager
Rate Administration

EXHIBIT 8-10

RESALE POWER SERVICE
RATE RP

I. Availability

At existing points of delivery and at such other points on the Company's interconnected system, as mutually agreed upon, where there are facilities of adequate capacity.

II. Applicability

This schedule shall be applicable to electric service purchased from the Company by other electric light and power systems taking their entire requirements from the Company for resale to ultimate consumers served from their respective distribution systems, where the billing demand is not less than 100 KW and service delivery is at not less than 2,400 volts. *

III. Net Rate (Per Month)

Service rendered hereunder shall be metered and billed at the rates set forth below separately for each delivery point:

Demand Charge

First	1,400 KW of billing demand	@	$2.06 per KW
Excess of	1,400 KW of billing demand	@	1.83 per KW

Energy Charge

First	200 KWH per KW of billing demand	@	1.08 cents per KWH
Next	200 KWH per KW of billing demand	@	0.81 cents per KWH
Excess of	400 KWH per KW of billing demand	@	0.62 cents per KWH

Untransformed Service

When service is supplied at 23,000 volts or over, and customer furnishes all necessary transformer and terminal equipment, the kilowatt demand charge per month shall be decreased 35¢ per KW of billing demand.

Fuel Cost Adjustment

Bills rendered under this rate schedule are subject to the Fuel Cost Adjustment Clause included in this tariff.

* Other types of electric service are offered by the Company under other rates which are or may be made available. This rate and the accompanying terms and conditions are designed for the particular characteristics of the service offered hereunder and are accordingly limited in their applicability to that service.

IV. Determination of Billing Demand

The measured demand will be the integrated 15-minute use of energy measured in kilowatts by indicating or recording instruments. The billing demand will be the largest of the following values: (a) the maximum measured demand taken at any time during the month, adjusted for power factor: (b) 100 KW: or (c) 75% of the highest billing demand in the preceding eleven months.

V. Power Factor Adjustment

When the power factor is less than 85%, the measured demand will be adjusted for billing purposes by multiplying by 85% and dividing by the power factor taken to the nearest tenth of a percent. Power factor may be determined by test or by permanently installed instruments at the Company's option.

VI. Payment Terms

Bills not paid within 15 days from the date of billing will be subject to a delayed payment charge of 1% of the bill including any applicable fuel clause amounts.

VII. General Terms and Conditions

Service under this Resale Power Service Rate RP is subject to the General Terms and Conditions of this tariff, Original Sheet Nos. 9 through 12 , or as the same may be amended from time to time or superseded pursuant to the filing and other provisions of the Federal Power Act.

RESALE POWER SERVICE

FUEL COST ADJUSTMENT CLAUSE

A fuel cost adjustment shall be applied to each kilowatt-hour supplied under this tariff. This fuel cost adjustment, determined to the nearest 0.01 mill in accordance with the formula set forth below, shall be applied to all kilowatt-hours supplied during the billing period.

$$A = (C - B) \times \frac{F}{I} \times \frac{I}{S}$$

Where A = Adjustment in mills per kilowatt-hour to be applied to each kilowatt-hour supplied under this tariff.

C = The current fuel cost in mills per kilowatt-hour net generation in Company's fossil-fuel fired generating stations, determined by dividing the month's total of that portion of Accounts 501 and 547 cleared through Account 151, by the net generation produced by fossil fuels in that month.

B = Base fossil fuel cost of 3.479 mills per kilowatt-hour.

F = 12 months to date kilowatt-hour totals of:
fossil fuel net generation,
plus such of the gross interchange and purchased power received as varies with the cost of fossil fuel, and
minus such of the gross interchange and purchased power delivered as varies with the cost of fossil fuel.

I = 12 months to date kilowatt-hour totals of:
total system net generation from all sources,
plus interchange and purchased power received, and
minus interchange and purchased power delivered.

S = 12 months to date total kilowatt-hour sales.

The "C" factor is to be determined for the second calendar month preceding the billing month.

The "F", "I" and "S" factors are to be determined as the 12 months to date totals for the period ending with the second calendar month preceding the billing month.

Minimum bills shall not be reduced by reason of this fuel adjustment clause. This fuel adjustment clause shall be applied to all kilowatt-hours supplied, and such charge shall be an addition to any minimums applicable.

Pennsylvania Electric Company

CALCULATION OF FUEL COST ADJUSTMENT CLAUSE
FOR RESALE POWER SERVICE, EXCLUDING COOPERATIVES

Applicable to FPC Electric Tariff, Original Volume No. 1

September 1973 Billing - Based on July 1973 Data

1.	Fossil Fuel Cost for Electric Generation (Accounts 501 and 547)	$ 4 389 439
2.	Less: Amortization of the Cost of Non-Recoverable Coal	2 317
3.	Less: Electric Fuel Handling Expenses	153 531
4.	Applicable Fossil Fuel Cost - July 1973	$ 4 233 591
5.	Fossil Generation, July 1973 - MWH	995 772
6.	Mills/KWH (Line 4 ÷ Line 5) - C	4.252
7.	Mills/KWH (Base) - B	3.479
8.	Difference (Line 6 minus Line 7)	0.773
9.	Fossil Fuel Generation, Twelve Months - MWH	10 141 274
10.	Interchange Received and Purchased Power, Twelve Months - MWH	732 268
11.	Interchange Delivered, Twelve Months - MWH	(768 080)
12.	Total (Line 9 plus Line 10 minus Line 11) - F	10 105 462
13.	Sales to Customers, Twelve Months - MWH - S	9 175 921
14.	F/S (Line 12 ÷ Line 13)	1.10130
15.	Fuel Cost Adjustment Clause (Line 8 x Line 14) - Mills/KWH	0.85*

*In accordance with Executive Order No. 11723 of the President of the United States, issued June 13, 1973, and Federal Power Commission Amended Statement of Policy, Docket No. R-427, Order No. 437-B, Implementation of the Economic Stabilization Act of 1970 and Executive Order No. 11723 (issued June 19, 1973, and effective June 13, 1973), the Fuel Cost Adjustment charge shall not exceed the 0.98 mills per kilowatthour charge in effect during the "freeze base period," June 1 to June 8, 1973.

G. Ballirano

G. BALLIRANO

Date: August 22, 1973

Copies to: R. C. Bartle, F. D. Hafer, E. F. Carter, R. C. Noon, F. P. Marra, C. E. Bross, N. A. Hagstrom, K. M. Keagy, J. A. Cobler

EXHIBIT 8-13

WHEELING AND SUPPLEMENTAL POWER AGREEMENT

AGREEMENT made as of July 22, 1965 between PENNSYLVANIA ELECTRIC COMPANY (hereinafter called the "Company"), a corporation organized and existing under the laws of the Commonwealth of Pennsylvania, and ALLEGHENY ELECTRIC COOPERATIVE, INC. (hereinafter called the "Cooperative"), a cooperative corporation organized and existing under the laws of the Commonwealth of Pennsylvania.

WHEREAS, the Cooperative is a federated cooperative association organized and owned by its member rural electric distribution cooperative associations (hereinafter called the "Members"); and

WHEREAS, the Cooperative has entered into a contract with Power Authority of the State of New York (hereinafter called the "Authority"), under which the Authority is to deliver 85,554 KW (30-minute integrated demand) of electric power to the Cooperative at the New York-Pennsylvania State Line; and

WHEREAS, the Cooperative desires to have such power delivered by the Company and another utility company within the Commonwealth of Pennsylvania to the points of delivery of the Members, and Company is willing so to deliver 79,394 KW of such power (hereinafter called the "Authority power"); and

WHEREAS, the Cooperative desires to purchase power and energy from the Company to supply the Members' requirements at the delivery points served by the Company in excess of the portion of such requirements which can be supplied with the Authority power and associated energy and the Company is willing to sell such supplemental power and energy;

NOW, THEREFORE, in consideration of the mutual undertakings herein contained, the parties hereby agree as follows:

1. *Delivery of Authority Power and Associated Energy.* The Cooperative shall arrange for the delivery of the Authority power and associated energy into the Company's transmission system at the New York-Pennsylvania State Line. The Company shall deliver Authority power and associated energy from the New York-Pennsylvania State Line to the delivery points of the Members at the voltages designated in Exhibit A attached hereto and made a part hereof, and to such additional delivery point or points as may be reasonably requested by the Cooperative, taking into consideration the respective interests of both the Company and the Cooperative; provided, however, that if the Company deems any such request to be unreasonable, the Cooperative may, at its own expense, make a connection to the Company's sub-transmission system (at voltages of 69 KV or below) to obtain power and energy for such delivery point, provided that such connection does not unduly impair the Company's operations and the planned development of its system. Each new delivery point shall be specified on an additional sheet of Exhibit A to be attached hereto and made a part hereof. (All delivery points as may from time to time appear in Exhibit A being hereinafter collectively called the "Delivery points").

The amount of Authority power to be delivered by the Company to each of the Members, measured at the delivery points (and computed as the arithmetic sum of the individual delivery point non-coincident 15-minute integrated KW peaks) (hereinafter called the "Allotted Authority power") shall initially be:

Member	KW
Adams Electric Cooperative, Inc.	2,534
Bedford Rural Electric Cooperative, Inc.	5,378
Central Electric Cooperative, Inc.	3,516
Claverack Electric Cooperative, Inc.	8,429
Clearfield Electric Cooperative, Inc.	4,602
Jefferson Electric Cooperative, Inc.	4,757
New Enterprise Rural Electric Cooperative, Inc.	2,275
Northwestern Rural Electric Cooperative Association, Inc.	13,083
Somerset Rural Electric Cooperative, Inc.	6,154
Southwest Central Rural Electric Cooperative Corporation	11,428
Sullivan County Rural Electric Cooperative, Inc.	2,637
Tri-County Rural Electric Cooperative, Inc.	6,981
Valley Rural Electric Cooperative, Inc.	8,532
Warren Electric Cooperative, Inc.	4,344
Total	84,650

The total amount of Allotted Authority power listed above is calculated by taking the total amount of Authority power of 79,394 KW, multiplying by 0.95 (to allow for 5% losses within Pennsylvania), dividing the results by 0.99 (to allow for the difference between a 15-minute and 30-minute demand) and dividing that result by 0.90 (to allow for diversity between delivery points).

Paragraph 3 of Appendix A to the contract between the Authority and the Cooperative apportions 11,800 KW (at Authority's Niagara Switchyard) of electric power to delivery points of Central Electric Cooperative, Inc. and Tri-County Rural Electric Cooperative, Inc. served by the West Penn Power Company. In the event that the Authority shall re-allocate and re-apportion 10,950 KW of such electric power to delivery points of the Members served by the Company, then, subject to adjustments as hereinafter provided, the total amount of Authority power under this Agreement shall be 90,016 KW and the amount of Allotted Authority power of each Member shall be:

Member	KW
Adams Electric Cooperative, Inc.	2,896
Bedford Rural Electric Cooperative, Inc.	6,050
Central Electric Cooperative, Inc.	4,033
Claverack Electric Cooperative, Inc.	9,567
Clearfield Electric Cooperative, Inc.	5,171
Jefferson Electric Cooperative, Inc.	5,378
New Enterprise Rural Electric Cooperative, Inc.	2,586
Northwestern Rural Electric Cooperative Association, Inc.	14,841
Somerset Rural Electric Cooperative, Inc.	6,981
Southwest Central Rural Electric Cooperative Corporation	12,980
Sullivan County Rural Electric Cooperative, Inc.	2,999
Tri-County Rural Electric Cooperative, Inc.	7,912
Valley Rural Electric Cooperative, Inc.	9,670
Warren Electric Cooperative, Inc.	4,913
Total	95,977

In view of the possibility that the amount of Authority power (i) may decrease in the future because of the right of the Authority, under paragraph (c) of Article II of the contract between Authority and the Cooperative, to withdraw a portion of Authority power originally allotted to the Cooperative or (ii) may be modified by increases or decreases in the deduction made by Authority for losses in transmission in New York State, corresponding adjustments proportionate to such increases or decreases shall automatically be made in the amounts of such power to be delivered hereunder to each Member if such increases or decreases occur. In the event of such an increase or decrease in Authority power, "Authority power" after the effective date of such an increase or decrease shall mean the Authority power as so increased or decreased by the Authority; and the "Allotted Authority power" of each Member as set forth in the applicable tabulation in this Section shall be correspondingly increased or decreased.

Any other modification or adjustment of Authority power or of the Allotted Authority power of any Member or Members shall require the written consent of the Company and the Cooperative.

2. *Sale of Power and Energy.* The Company shall sell to the Cooperative and deliver to the delivery points of the Members all of the electric power and energy required by the Members in excess of the amount of Authority power and associated energy delivered hereunder by the Company to the delivery points (such excess being hereinafter called the "supplemental power and energy") and the Cooperative shall buy the supplemental power and energy; provided, however, that in the cases of Adams Electric Cooperative, Inc., Central Electric Cooperative, Inc. and Tri-County Electric Cooperative, Inc. which are purchasing power from additional suppliers on the effective date of this Agreement, this

Agreement shall not apply to service to the portions of such Members' systems served by such other suppliers on said date. The withdrawal of a Member from membership in the Cooperative shall not affect the respective rights and obligations of the Company and Cooperative under this Section and for the purposes of this Section the withdrawal of a Member shall not affect such rights and obligations during the life of this Agreement.

3. *Amount of Authority Power and Associated Energy to be Delivered to Each Member Monthly.* The amount of power supplied to any Member deemed to be supplied by Authority shall be determined by multiplying the Allotted Authority power for such Member by a fraction, the numerator of which shall be the sum of the monthly demands of such Member for such month (determined as the arithmetic sum of the individual delivery point non-coincident, 15-minute maximum demands during the month) and the denominator of which shall be the highest sum of the monthly demands of such Member established in either such month or in any of the preceding eleven months; provided, however, that the delivered Authority power in any month as thus determined shall not exceed the sum of the monthly maximum 15-minute demands of such Member in such month. (The amount of power deemed to be supplied by Authority as set forth in the preceding sentence is hereinafter called the "delivered Authority power".) All of the remainder of the power delivered by the Company to such Member in any month shall be deemed to be supplemental power (hereinafter called "supplemental power") sold by the Company to the Cooperative hereunder.

The amount of energy delivered to a Member in any month deemed to be energy associated with delivered Authority power shall be determined by multiplying the total amount of energy delivered to such Member by the Company during such month by a fraction, the numerator of which is the amount of delivered Authority power to such Member during such month and the denominator of which is the arithmetic sum of the individual delivery point non-coincident 15-minute maximum demands for such Member for such month, provided, that the amount of energy deemed to be associated with delivered Authority power may be modified on occasion as provided in Exhibit C attached hereto. All additional energy delivered hereunder during such month to such Member shall be deemed to be supplemental energy (hereinafter called "supplemental energy") sold by the Company to the Cooperative hereunder.

The delivered Authority power shall be deemed to be divided among the delivery points of a Member each month in proportion to the ratio that the monthly maximum 15-minute demand at each delivery point of such Member in such month bears to the arithmetic sum of the individual delivery point non-coincident 15-minute maximum demands for such Member in such month. The amount of energy associated with the delivered Authority power for a Member each month shall be deemed to be divided among the delivery points of the Member in proportion to the ratio that the KWH of energy metered at each delivery point of such Member in such month bears to the sum of the KWH of energy metered at all delivery points of such Member in such month.

4. *Amount of Authority Power and Associated Energy to be Delivered by Authority into Company's System Monthly.* To allow for diversity among the delivery points, the sum of the delivered Authority power monthly to all the Members shall be multiplied by 0.90 (the result being hereinafter called the "Company's coincident 15-minute delivery of Authority power"). The Company's coincident 15-minute delivery of Authority power shall be multiplied by 0.99 (1% allowance for the difference between a 15-minute peak and a 30-minute peak) and the result divided by 0.95 (5% allowance for Pennsylvania transmission losses) to determine the monthly 30-minute KW peak demand which the Cooperative is required to have delivered by the Authority into the Company's system at the New York-Pennsylvania State Line.

The amount of energy which the Cooperative is required to have delivered monthly by the Authority into the Company's system at the New York-Pennsylvania State Line shall be determined by dividing the sum of the KWH of energy delivered hereunder deemed to be associated with Authority power to all of the Members by 0.95 (5% allowance for Pennsylvania transmission losses). In the event such delivery of energy is limited by the Authority as provided in the contract between the Cooperative and the Authority, the energy limitation provision contained in Exhibit C shall apply.

5. *New Delivery Points — Transfer of Loads.* In the event a new delivery point is added or other changes are made which result in the transfer of load from one delivery point of a Member to another delivery point of such Member within the Company's service area within any billing month, appropriate adjustment shall be made by the Company in such Member's demands to preclude duplication of the same demand.

6. *Monthly Rate for Delivery of Power.* The Cooperative shall pay the Company for the delivery hereunder of Authority power to the Members' delivery points at the monthly rate of 97¢ per KW of the Company's coincident 15-minute delivery of Authority power.

7. *Rate for Power and Energy Sold.* The Cooperative shall pay the Company for all supplemental power and energy purchased hereunder in accordance with the rates, charges and conditions set forth in the schedule attached hereto as Exhibit B and made part hereof.

The power factor provision contained in Exhibit B hereto shall not affect the determination, under Section 3 hereof, of the amount of power deemed to be Authority power and the amount deemed to be supplemental power, but shall be utilized only for the purposes of determining the billing demand for supplemental power at each delivery point under the provisions of Exhibit B.

8. *Character of Service.* Alternating current, 60 cycle, 3 phase at not less than 23,000 volts (nominal) except at the option of the Company, with consent of the Cooperative. Voltages are to be maintained within the limits of voltage variation measured at the Members' delivery points of plus or minus 10% of the nominal voltage specified on Exhibit A.

9. *Connections.* Members, at their expense, shall install and maintain fuses, disconnecting switches, oil switches, transformers or other apparatus at the point of connection of the Member's lines to the Company's lines which may reasonably be necessary to enable the Member to receive and use the power and energy delivered hereunder and which the Company specifies as necessary to protect its system; provided, however, that the protective equipment specified by the Company shall be consistent with that which the Company would normally install on its own system under like circumstances.

10. *Isolation of Any Grounded Line.* In the event that any Member shall construct lines, or any portions thereof, for operation with one conductor grounded, it shall notify the Company in advance of its intention to do so. If the Company is to supply power and energy to such lines or portions thereof from lines of the same voltage which do not have a grounded conductor, the Company may, at its option, require that an isolating transformer be supplied, installed and maintained by such Member for the purpose of electrically isolating its grounded lines from the Company's system.

11. *Non-parallel Operation.* The portion of any Member's electric system supplied through any point of delivery by Company shall not be operated in parallel with any other source of power unless mutually agreed to previously.

12. *Notice of Planned Outage.* The Company shall, if practicable, give Cooperative at least 14 days' written notice of any scheduled or planned outage which would affect the supply of electricity to any Member. In case such notice is not possible or in case of unscheduled outages, Company shall give Cooperative as much notice as circumstances shall permit.

13. *Meter Readings and Payment of Bills.* The Company shall read meters monthly, and meter readings of the amounts of power and energy delivered to Members from all sources at each of their designated delivery points for billing periods of approximately 30 days ending between the 20th of each month and the 20th of the month preceding (or the nearest working day thereto in each case) shall be provided to the Authority and the Cooperative not later than the 28th of the month. At the Company's election, metering may be at the Company's delivery voltage or on the low voltage side of the Member's transformer banks. Where the Company meters on the low voltage side, the Company may

utilize transformer loss compensators at the metering point to determine the actual demand, energy and reactive supply at the delivery point; and if no transformer loss compensator is used at the metering point, the meter registration shall be adjusted to compensate for transformer losses. On request of the Cooperative, the Company shall furnish data supporting the compensator settings for the purpose of checking such settings.

All services furnished by the Company hereunder shall be paid for at the office of the Company in Johnstown, Pennsylvania, monthly within fifteen (15) days after the bill therefor is mailed to the Cooperative. If the Cooperative shall fail to pay any such bill within such fifteen-day period, the Company may discontinue supplying services hereunder upon fifteen (15) days' written notice to the Cooperative of its intention so to do. Whether or not the Company shall have discontinued supplying services hereunder, if the Cooperative shall fail to pay any bill submitted by the Company within thirty (30) days after such bill is mailed to the Cooperative, a delayed payment charge of five per cent (5%) of the bill shall be due and payable.

14. *Meter Testing and Billing Adjustment.* The Company shall test and calibrate meters by comparison with accurate standards at intervals not to exceed twenty-four (24) months. The Company shall also make special meter tests at any time at the Cooperative's request. The cost of all tests shall be borne by the Company; provided, however, that if any special meter test made at the Cooperative's request shall disclose that the meters are recording accurately, the Cooperative shall reimburse the Company for the cost of such test. Meters registering not more than two per cent (2%) above or below normal shall be deemed to be accurate. The readings of any meter which shall have been disclosed by test to be inaccurate shall be corrected for the ninety (90) days previous to such test in accordance with the percentage of inaccuracy found by such test. If any meter shall fail to register for any period the Cooperative and the Company shall agree as to the amount of energy furnished during such period and the Company shall render a bill therefor.

15. *Notice of Meter Reading or Test.* The Company shall notify, by telephone or in writing, the Cooperative or the Member affected of the time of any meter test so that the Cooperative's or Member's representative may be present at such test. The Company, at the request of the Cooperative, shall furnish the Cooperative with a schedule of the meter reading dates so that the Cooperative's representative may be present for the monthly meter readings if desired.

16. *Right of Access.* Duly authorized representatives of either party hereto shall be permitted to enter the premises of the other party hereto at all reasonable times in order to carry out the provisions hereof. For the purposes of this Section, the premises of the Cooperative shall be deemed to include the premises of the Members.

17. *Continuity of Service.* The Company shall use reasonable diligence to maintain uninterrupted service in (i) its transmission of Authority power and (ii) delivery of supplemental power and energy hereunder, but shall not be liable for damages due to variations or cessations in such transmission or supply. The Company may at any time that it deems necessary, suspend the supply of electrical energy to any Member for the purpose of making requisite repairs, changes or improvements on any part of its system. Circumstances permitting, it will give reasonable notice of any contemplated suspension. If the Company should be prevented from delivering, or a Member from receiving, all or any portion of the electrical energy contracted for due to accident, strike, riot, war, fire, explosion. storms, lightning, Order of Court, Act of God, failure to secure the necessary rights of way, delay in the delivery of necessary equipment or material, or inherent characteristics peculiar to a particular industry, thus resulting in a complete cessation of a Member's operations (or delay in commencing operations), the Company shall not be obligated to supply, nor the Member to receive, electrical energy while such cause exists. An adjustment of billing in the Member's favor may be made under such circumstances. The Company shall not refuse to supply, nor a Member to receive, electrical energy as soon as the cause of the interruption is removed and each shall be prompt and diligent in removing and overcoming such cause. With respect to the portion of the load of the Cooperative or its Members which is to be

served with Authority power, the Company's obligation is limited to furnishing transmission and the Company does not undertake under this Agreement to provide standby capacity and energy to the Cooperative or its Members to meet any of their requirements which may arise by reason of the Authority's failure or inability for any reason whatsoever to deliver all or any part of the Authority power into the Company's transmission system at the New York-Pennsylvania State Line.

18. *Interconnected Operations.* The parties recognize that the electric power facilities of the Authority and of the Company are normally operated as a part of a major interconnected and coordinated system and that disturbances originating in one area can affect operations which are geographically remote. The Cooperative, its Members and the Company shall use their best efforts to avoid interfering with such interconnected and parallel operations.

19. *Delivery Schedules.* (a) The Cooperative shall arrange for inclusion in its above-mentioned contract with the Authority of provisions which provide in substance that:

(i) The Authority shall agree with the Company upon schedules for the delivery of Authority power and associated energy in each billing period that will equal as nearly as may be the amounts of Authority power and associated energy which Authority shall be obligated under its contract with the Cooperative to deliver in that billing period and shall establish hourly schedules which will apportion the Authority power and associated energy between hours of the month so as to parallel as nearly as practicable the hourly pattern of power requirements of the Members at the delivery points; and

(ii) Amounts by which Authority power and associated energy supplied by Authority exceed or are less than Authority obligation under its contract with the Cooperative for any billing period shall be adjusted by compensating increases or decreases in deliveries to the Company in subsequent months.

(b) The Cooperative authorizes the Company to agree on behalf of the Cooperative and its Members, with the Authority upon the schedules described above in this Section 19.

20. *Use by Cooperative and Members.* All transmission service and supplemental power and energy supplied by the Company under this Agreement shall only be for the use of the Cooperative, its Members and the ultimate customers of such Members, and, except for borderline customers, neither the Cooperative nor any Member thereof shall make any part of the Authority power or supplemental power and energy available to any other utility system (of any kind or description) for resale.

21. *Liability of Members.* The Cooperative represents that it has been authorized to execute this Agreement on behalf of each of the Members named in Section 1 hereof, and the Cooperative agrees that it will not consent to any termination of such authority prior to the expiration of the term of this Agreement as provided in Section 23 hereof. In the event that the Cooperative shall not have duly and promptly fulfilled its obligations and undertakings as set forth in this Agreement, each Member shall be (i) individually liable to the Company for the performance of its obligations and undertakings as a Member as specified in this Agreement and (ii) severally liable to the Company for the obligations and undertakings of the Cooperative under this Agreement with respect to the service furnished to such Member and any and all other obligations of the Cooperative under this Agreement applicable to the system of such Member and the territory in which such Member operates. The several liability of a Member to the Company as specified in this Section shall continue throughout the life of this Agreement, notwithstanding the withdrawal by it from membership in the Cooperative.

22. *Notices.* The Cooperative shall arrange for prompt delivery to the Company of copies of all notices with respect to installments, withdrawals, increases, decreases or other adjustments of Authority power.

23. *Term.* This Agreement shall become effective only upon the happening of the last to occur of the following events: (i) approval in writing of the Administrator of the Rural Electrification Administration; (ii) compliance with any applicable requirements (including the expiration of any requisite period after filing) as to approval or filing of any regulatory agencies which have jurisdiction with respect to the subject matter of this Agreement; and (iii) the date on which the Authority first makes power and energy available to the Company under the provisions of the above-mentioned contract between the Authority and the Cooperative for the delivery of Authority power; and this Agreement shall remain in effect for a period of five (5) years from the effective date hereof and thereafter until terminated by either party giving to the other not less than thirty months' written notice of its intention to terminate, which notice may be given either prior or subsequent to the expiration of the initial five-year period. Without limiting in any respect the rights or powers of either the Company or the Cooperative to terminate this Agreement upon the giving of due notice as specified in the preceding sentence, the parties mutually recognize that each of them has the right and power to terminate this Agreement upon such due notice if they are unable to agree on the rates to be charged by the Company after the initial five (5) year period for the Company's delivery of Authority power and/or the Company's supply of supplemental power and energy. This Agreement shall be binding upon the Company and the Cooperative, their successors and assigns.

EXECUTED the day and year first above mentioned.

PENNSYLVANIA ELECTRIC COMPANY
Company

By LOUIS H. RODDIS, JR.
President

ATTEST:

R. F. PRUNER
Secretary

ALLEGHENY ELECTRIC COOPERATIVE, INC.
Cooperative

By W. J. MCDANEL
President

ATTEST:

ROSCOE M. KEMP
Secretary

EXHIBIT 8-14f

EXHIBIT A

DELIVERY POINTS

Name of Delivery Point	Location: Township	Location: County	Delivery Voltage (Volts)
FOR ADAMS ELECTRIC COOPERATIVE, INC.:			
Pinola	Southampton	Franklin	23,000
McCrea	Lower Mifflin	Cumberland	23,000
FOR BEDFORD RURAL ELECTRIC COOPERATIVE, INC.:			
Bedford	Bedford	Bedford	23,000
Lovely	W. St. Clair	Bedford	23,000
Point	Napier	Bedford	23,000
Everett	W. Providence	Bedford	23,000
Snake Spring Valley	Snake Spring	Bedford	23,000
Burning Bush	Bedford	Bedford	23,000 (C)
FOR CENTRAL ELECTRIC COOPERATIVE, INC.:			
Rockland	Rockland	Venango	34,500
Wolfs Corner	Washington	Clarion	34,500
Coal Hill	Pine Grove	Venango	34,500
Starr	Green	Forest	34,500
Beaver	Beaver	Clarion	34,500
FOR CLAVERACK ELECTRIC COOPERATIVE, INC.:			
Franklin Forks	Franklin	Susquehanna	34,500
Litchfield	Litchfield	Bradford	34,500
Towanda	Towanda	Bradford	34,500
Middletown	Middletown	Susquehanna	34,500
Evergreen	Albany	Bradford	34,500
Lime Hill	Wyalusing	Bradford	34,500
Hollenbeck	Wilmot	Bradford	34,500
West Leroy	Leroy	Bradford	34,500
Brooklyn	Brooklyn	Susquehanna	34,500
Dusterhout	Tunkhannock	Wyoming	34,500
Meshoppen	Auburn	Susquehanna	34,500 (C)
Steinbach Corners	Jackson	Susquehanna	34,500
Hop Bottom	Lenox	Susquehanna	34,500 (C)
South Montrose	Dimock	Susquehanna	34,500 (C)
FOR UNITED ELECTRIC COOPERATIVE, INC.:			
Pike	Pike	Clearfield	34,500
Goshen	Goshen	Clearfield	34,500
Five Point	Chest	Clearfield	34,500
Graham	Graham	Clearfield	34,500
Oak Hill	Karthaus	Clearfield	34,500
Erhart	Knox	Clearfield	34,500
Henderson	Henderson	Jefferson	34,500
Oklahoma	Sandy	Clearfield	34,500
McGee	Bell	Clearfield	34,500
Red Mill	Washington	Jefferson	34,500
Leeper	Farmington	Clarion	34,500
Grange	Porter	Jefferson	34,500 (C)
Conifer	Beaver	Jefferson	34,500
Fernandago	Bell	Jefferson	34,500
Howe	Eldred	Jefferson	34,500
Warsaw	Warsaw	Jefferson	34,500
Brockway	Snyder	Jefferson	7,200
Sigel	Eldred	Jefferson	34,500
FOR NEW ENTERPRISE RURAL ELECTRIC COOPERATIVE, INC.:			
Saltillo	Clay	Huntingdon	23,000
Waterside	South Woodbury	Bedford	12,000
Eichelbergertown	Hopewell	Bedford	23,000
FOR NORTHWESTERN RURAL ELECTRIC COOPERATIVE ASSOCIATION, INC.:			
Oil Creek	Rome	Crawford	34,500 (C)
Elgin	Elgin (Boro)	Erie	34,500
Crane Road	Washington	Erie	34,500
Geneva	Union	Crawford	34,500 (C)
Saegertown	Hayfield	Crawford	34,500
Teepleville	Richmond	Crawford	34,500
Plum Township	Plum	Venango	34,500
Mt. Hope	Randolph	Crawford	34,500
Tamarack	East Mead	Crawford	34,500
Shadeland	Spring	Crawford	34,500
Dicksonburg	Summerhill	Crawford	34,500
Vernon	Vernon	Crawford	34,500
FOR SOMERSET RURAL ELECTRIC COOPERATIVE, INC.:			
Hays Mills	Brothers Valley	Somerset	23,000
White Horse	Stoneycreek	Somerset	23,000
Shade Township	Shade	Somerset	23,000
Milford Township or Bando	Milford	Somerset	23,000
Listonburg	Addison	Somerset	23,000
Glessner	Jenner	Somerset	23,000
Trent	Middlecreek	Somerset	23,000
Mason - Dixon	Addison	Somerset	23,000
Edie	Lincoln	Somerset	23,000
Markleton	Upper Turkeyfoot	Somerset	23,000
Ralphton	Jenner	Somerset	23,000
Indian Lake	Stoneycreek	Somerset	23,000 (C)

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ENVIRONMENTAL STATEMENT, LAKE CITY STATION, UNIT ONE.(U)
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3 OF 4

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EXHIBIT A—(Continued)

DELIVERY POINTS

Name of Delivery Point	Location: Township	Location: County	Delivery Voltage (Volts)
FOR SOUTHWEST CENTRAL RURAL ELECTRIC COOPERATIVE CORPORATION:			
Parkwood	Armstrong	Indiana	23,000 (C)
Brttle	Richland	Cambria	23,000
Summerhill	Summerhill	Cambria	23,000
Fairview	Jackson	Cambria	23,000
Cherryhill	Cherryhill	Indiana	23,000
Kenwood	Cherryhill	Indiana	23,000 (C)
Locust	Canoe	Indiana	23,000
Washington	Washington	Indiana	34,500
Livermore	Blacklick	Indiana	23,000 (C)
Shadowood	White	Indiana	23,000
Campbell	Brush Valley	Indiana	23,000
Cookport	Green	Indiana	34,500
St. Augustine	Clearfield	Cambria	46,000
Sunset	E. Carroll	Cambria	12,500
Reese	Cambria	Cambria	46,000
Belsano	Blacklick	Cambria	46,000
Georgeville	South Mahoning	Indiana	23,000 (C)
Browns Crossing	Conemaugh	Indiana	12,500
Smithport	Banks	Indiana	34,500
Amsbry	Gallitzin	Cambria	12,500
FOR SULLIVAN COUNTY RURAL ELECTRIC COOPERATIVE, INC.:			
Shore Acres	Plunketts Creek	Lycoming	34,500 (C)
Estella and Hillsgrove	Elkland	Sullivan	34,500
Laporte	Laporte	Sullivan	34,500
FOR TRI-COUNTY RURAL ELECTRIC COOPERATIVE, INC.:			
Sullivan	Sullivan	Tioga	34,500
Westfield	Westfield	Tioga	34,500
Liberty	Liberty	Tioga	34,500 (C)
Nelson	Lawrence	Tioga	34,500
Harrison Valley	Harrison	Potter	34,500
Columbia Cross Roads	Columbia	Bradford	34,500
Ayers Corners	Smithfield	Bradford	34,500 (C)
Jackson Center	Jackson	Tioga	34,500
Genessee	Genessee	Potter	12,500
Galeton	Pike	Potter	34,500
Morris	Morris	Tioga	34,500
Milan	Smithfield	Bradford	34,500
FOR VALLEY RURAL ELECTRIC COOPERATIVE, INC.:			
Frankstown	Frankstown	Blair	46,000
Long or Puzzletown	Freedom	Blair	23,000 (C)
Ore Hill	Taylor	Blair	23,000
Williamsburg	Catherine	Blair	46,000
Little Valley	Todd	Huntingdon	23,000 (C)
Sinking Valley	Tyrone	Blair	46,000
Shade Valley	Dublin	Huntingdon	23,000
Center Union	Oneida	Huntingdon	46,000 (C)
Neffs Mills	Barree	Huntingdon	46,000
Piney Ridge	Walker	Huntingdon	46,000
Three Springs	Cromwell	Huntingdon	23,000
Harrisonville	Springfield	Huntingdon	23,000 (C)
Cassville	Cass	Huntingdon	23,000 (C)
Atkinsons Mills	Wayne	Mifflin	46,000
Reeds Gap	Tuscarora	Juniata	23,000
Metal	Metal	Franklin	23,000
Carson Valley	Allegheny	Blair	46,000
FOR WARREN ELECTRIC COOPERATIVE, INC.:			
Akeley	Pine Grove	Warren	12,000
Irvine	Broken Straw	Warren	34,500
Pittsfield	Pittsfield	Warren	34,500
Hemlock	Triumph	Warren	34,500 (C)
Spring Creek	Springcreek	Warren	34,500
Whig Hill	Kingsley	Forest	34,500
Frost	Jenks	Forest	12,000 (C)
Tidioute	Limestone	Warren	12,000 (C)
Pleasantville	Oilcreek	Venango	12,000 (C)
Pine Valley	Columbus	Warren	12,000

7th Revision
September 27, 1971

(C) - Change

EXHIBIT 8-14h

EXHIBIT B

SUPPLEMENTAL POWER AND ENERGY

NET RATE FOR SERVICE AT EACH DELIVERY POINT (Per Month):

First	50 hours' use of billing demand at	\$.02122 per kwh
Next	150 hours' use of billing demand at	.00822 per kwh
Excess of	200 hours' use of billing demand at	.00672 per kwh

TAX PROVISIONS:

In addition to the rates and charges stated above, there shall be added a pro rata share of any increase in the rate of gross receipts tax, sales tax, ad valorem tax or any other tax imposed upon the facilities of the Company used in serving the Cooperative, or measured in part or in whole by the sales of the Company to the Cooperative or the receipts by the Company from the Cooperative.

MINIMUM CHARGE:

Except as to delivery points eliminated by written agreement between the Company and the Cooperative, the minimum monthly charge for supplemental power and energy for each delivery point shall be at the rate of \$1.75 per kilowatt of the maximum billing demand for supplemental power established during the preceding twelve months including the current month.

POWER FACTOR PROVISION AND BILLING DEMAND:

If the ratio of kilowatts to kilovolt-amperes recorded at the time of the monthly maximum fifteen-minute integrated demand at a particular delivery point indicates that the power factor differs from 85%, the monthly billing demand for supplemental power for such delivery point shall be determined by

(a) multiplying (i) the portion of such monthly recorded maximum fifteen-minute integrated demand which is supplemental power by (ii) 0.85 and

(b) dividing the result by the power factor indicated at the time of said monthly recorded maximum fifteen-minute integrated demand.

EXHIBIT C

ENERGY LIMITATION PROVISION

There is included in the contract between the Cooperative and the Authority a load factor limitation provision whereby the delivery of energy by the Authority may be limited by the Authority, such limitation to be effected at the option of the Company either (i) only at times when the total combined load of the Cooperative's Members is expected to be less than eighty per cent of the Cooperative's monthly peak or (ii) only at times when the power requirements of the Company to serve its own firm loads are expected to be less than eighty per cent of its monthly peak. In the event of such limitation, the Company shall supply deficiency energy and such energy will then be a part of the supplemental energy and billed by the Company to the Cooperative on the supplemental energy rate contained in Exhibit B.

Within 60 days after the conclusion of each calendar year the Cooperative shall submit to the Company the total reduction, if any, in energy deliveries for the Cooperative which has resulted from application of the energy limitation factor during such calendar year and which quantity or amount, Authority, if it finds feasible, may replace. This deficiency of energy, if any, shall be apportioned among the months of the year as to which such deficiency is computed in proportion to the reductions in energy availability resulting from the application of the load factor limitation provision.

Upon request of the Cooperative and to the extent that, at times mutually agreeable to the Authority and the Company, the Authority makes energy available to replace all or part of the energy deficiency apportioned to any month within 24 months after the close of that month but not later than the termination date of the contract of which this Exhibit is a part, the Company shall receive such replacement energy (in addition to the energy made available under other provisions of this contract) and the *supplemental energy supplied under the contract shall be correspondingly reduced*

Any decrease in deliveries of energy by the Authority or receipt of replacement energy in accordance with the foregoing provisions shall be proportioned among the Cooperative's Members in proportion to the respective amounts of energy made available by Authority for each prior to such adjustment.

AMENDMENT

TO

WHEELING AND SUPPLEMENTAL POWER AGREEMENT

Between

PENNSYLVANIA ELECTRIC COMPANY

and

ALLEGHENY ELECTRIC COOPERATIVE, INC.

Made as of July 22, 1965

To reflect the Wheeling of the full PASNY allotment on a year-round basis.

EXHIBIT 8-15

AMENDMENT TO WHEELING AND SUPPLEMENTAL POWER AGREEMENT

AMENDMENT, dated as of SEP 1 1972, to WHEELING AND SUPPLEMENTAL POWER AGREEMENT (hereinafter called the "Agreement"), made as of July 22, 1965, between Pennsylvania Electric Company (hereinafter called the "Company"), a corporation organized and existing under the laws of the Commonwealth of Pennsylvania, and Allegheny Electric Cooperative, Inc., (hereinafter called the "Cooperative"), a cooperative corporation organized and existing under the laws of the Commonwealth of Pennsylvania.

WHEREAS, the Cooperative intends to enter into a new contract with the Power Authority of the State of New York (hereinafter called the "Authority"), under which the Authority is to deliver firm power and associated energy up to the contract demand therein specified (namely, 100,000 KW at the Authority's Niagara Switchyard, which said contract specifies shall be deemed to be 97,000 KW at the New York-Pennsylvania State Line unless and until the factor for losses in transmission in New York is modified); and

WHEREAS, the Cooperative desires to have such power delivered by the Company and other utility companies to the points of delivery of the Cooperative (as defined in the Agreement), and Company is willing to deliver 90,016 KW of such power (hereinafter called "Authority power").

NOW, THEREFORE, in consideration of the mutual undertakings herein contained, the parties hereby agree as follows:

1. Section 1 of the Agreement is amended to read as follows:

"1. Delivery of Authority Power and Associated Energy.

(a) The Cooperative shall arrange for the delivery of the Authority power and associated energy into the Company's transmission system at the New York-Pennsylvania State Line. The Company shall deliver Authority power and associated energy from the New York-Pennsylvania State Line to the delivery points of the Cooperative at the voltages designated in Exhibit A attached hereto and made a part hereof, and to such additional delivery point or points as may be reasonably requested by the Cooperative, taking into consideration the respective interests of both the Company and the Cooperative; provided, however, that, if the Company deems any such request to be unreasonable, the Cooperative may, at its own expense, make a connection to the Company's sub-transmission system (at voltages of 69 KV or below) to obtain power and energy for such delivery point, provided that such connection does not unduly impair the Company's operations and the planned development of its system. Each new delivery point shall be specified on an additional sheet of Exhibit A to be attached hereto and made a part hereof. (All delivery points as may from time to time appear in Exhibit A are hereinafter collectively called the 'Delivery points'.)

(b) The amount of Authority power to be delivered each month by the Company to the Cooperative, measured at the Delivery points (and computed as the arithmetic sum of the individual delivery point non-coincident 15-minute integrated KW peaks)

(hereinafter called the 'Allotted Authority power') shall be 95,977 KW. The total amount of Allotted Authority power set forth above is calculated by taking the total amount of Authority power of 90,016 KW, multiplying by 0.95 (to allow for 5% losses within Pennsylvania), dividing the result by 0.99 (to allow for the difference between a 15-minute and 30-minute demand), and dividing that result by 0.90 (to allow for diversity between delivery points).

(c) In view of the possibility that the amount of Authority power (i) may decrease in the future because of the right of the Authority, under paragraph (c) of Article II of the contract between Authority and the Cooperative, to withdraw a portion of Authority power originally allotted to the Cooperative, or (ii) may be modified by increases or decreases in the deduction made by Authority for losses in transmission in New York State, corresponding adjustments proportionate to such increases or decreases shall automatically be made in the amounts of such power to be delivered hereunder to the Cooperative if such increases or decreases occur. In the event of such an increase or decrease in Authority power, 'Authority power' after the effective date of such an increase or decrease shall mean the Authority power as so increased or decreased by the Authority; and the 'Allotted Authority power' as set forth above shall be correspondingly increased or decreased.

(d) Any other modification or adjustment of Authority power or of the Allotted Authority power shall require the written consent of the Company and the Cooperative."

2. Section 3 of the Agreement is amended to read as follows:

"3. <u>Amount of Authority Power and Associated Energy to be Delivered to Each Delivery Point Monthly</u>.

There shall be determined monthly a fraction (hereinafter called the 'Split Ratio') having, as its numerator, the Allotted Authority power, and, as its denominator, the arithmetic sum of the individual delivery point non-coincident, 15-minute maximum demands during the month; provided, however, that the Split Ratio shall never be greater than unity. The amount of power supplied to each Delivery point deemed to be supplied by Authority shall be determined by multiplying the current monthly 15-minute peak demand of such Delivery point by the Split Ratio. (The amount of power deemed to be supplied by the Authority as set forth in the preceding sentence is hereinafter called 'Delivered Authority power'.) All of the remainder of the power delivered by the Company to such Delivery point in any month shall be deemed to be supplemental power (hereinafter called 'Supplemental power') sold by the Company to the Cooperative hereunder. The amount of energy delivered to a Delivery point in any month deemed to be energy associated with Delivered Authority power shall be determined by multiplying the total amount of energy delivered to such Delivery point by the Company during such month by the Split Ratio, provided that the amount

of energy deemed to be associated with Delivered Authority power may be modified on occasion as provided in Exhibit C attached hereto. All additional energy delivered hereunder during such month to such Delivery point shall be deemed to be supplemental energy (hereinafter called 'Supplemental energy') sold by the Company to the Cooperative hereunder. The sum of all of the Delivered Authority power at all Delivery points shall be equal to the Allotted Authority power, and, if necessary, the Delivered Authority power at one of the Delivery points shall be adjusted accordingly."

3. Section 11 of the Agreement is amended to read as follows:

"11. Non-Parallel Operation. The Cooperative represents and warrants that the portion of Cooperative's load supplied by Company will be separated from the remainder of Cooperative's load served by other utilities so that there will be no problem of parallel flow through the facilities of Cooperative between Company and any other utility. In the event that an unusual or emergency situation develops in which such parallel operation would improve service continuity or reliability, the Company shall be notified of such proposed operation and the operating problems resulting from such parallel operation, including those of system stability, relaying and metering, shall be resolved before any paralleling is done."

4. Section 20 of the Agreement shall be amended by its elimination in its entirety.

5. The Cooperative has represented that application of the MINIMUM CHARGE provision set forth in Exhibit B to the July 22, 1965 agreement would represent an undue burden on the Cooperative over the balance of the contract term and has requested, and the Company has agreed, that that MINIMUM CHARGE be waived for the duration of the term of this Amendment. In lieu thereof, the Cooperative shall pay monthly $600 to offset the approximate level of present payments under the MINIMUM CHARGE provision being waived.

It is further recognized that as experience is gained under the operation of this Amendment, it may be possible to establish an appropriate and higher minimum charge which will reimburse the Company for the fixed and other charges associated with the Company's investment made for service to Delivery points with poor load factors, but not impose a burden on the Cooperative inconsistent with the Cooperative's objective in seeking this Amendment.

6. This Amendment shall become effective only upon the happening of the last to occur of the following events:

(i) Approval in writing of the Administrator of the Rural Electrification Administration;

(ii) Compliance with any applicable requirements (including the expiration of any requisite period after filing) as to approval by, or filing with, any regulatory agency or agencies which have jurisdiction with respect to the subject matter of this Amendment; and

(iii) The date on which the Authority first makes power and energy available to the Company under the provisions of the contract to be entered into between the Authority and the Cooperative for the delivery of Authority power.

7. Except as expressly amended above, all of the terms and conditions of the Agreement made as of July 22, 1965 shall remain in full force and effect until the Agreement as hereby amended shall terminate on the earlier of (a) November 10, 1973 or (b) such date, if any, as shall be lawfully fixed by the Federal Power Commission in the proceedings relating to the Agreement which that Commission has initiated upon the request of the Company.

Executed the day and year first above mentioned.

PENNSYLVANIA ELECTRIC COMPANY

Attest:

Secretary

President

ALLEGHENY ELECTRIC COOPERATIVE, INC.

Attest:

Don Hill

Secretary

PENNSYLVANIA DER CLEARING HOUSE

Comment

Standards and Permits:

According to the Environmental Statement, all environmental effects are within the limits of State and Federal standards and there is no local opposition to the power plant.

A Department of Environmental Resources, Water Quality Management Industrial Wastes Permit No. 2572205 was issued on December 8, 1972, for this proposed facility. The Impact Statement was reviewed concerning the proposed industrial waste treatment units and diffuser outfall into Lake Erie. The Impact Statement is generally in agreement with previous data and information submitted to the Department of Environmental Resources by the Pennsylvania Electric Company for the Lake City Station.

Response

No comment is deemed necessary.

Comment

Outfall:

Several areas of comment concerning the diffuser outfall do exist. They are as follows:

1. The impact statement proposed a 1400 ft. long outfall compared to a proposed outfall of approximately 1850 feet long permitted by Water Quality Management permit No. 2572205. Subsequent contact with the Company's consultant engineer on this showed that the 1850 feet length was specified using maps of the area. Since then, an actual site survey indicated that the minimum depth needed for adequate heat dispersion could be attained 1400 feet from shore. This is acceptable to the Bureau of Water Quality Management.

2. The impact statement specifies a diffuser of 24 inches diameter, 80 feet long for one unit. Data submitted for Water Quality permit specified a 16 inch diameter 80 feet long diffuser for one unit and 24 inch diameter 160 feet long diffuser for two units. The diffuser for one unit will now be installed at a 24 inch diameter 80 feet long accommodating the future installation of a second unit. This is acceptable to the Bureau of Water Quality Management.

3. The permitee will be requested to submit "as built" plans of the outfall and diffuser.

Response

No comment is deemed necessary for comment 1 and 2. The applicant will submit "as built" plans of the outfall and diffuser to the Pennsylvania DER Clearing House as requested.

Comment

Erosion:

One other point of comment concerns soil and erosion control during construction of the facility. Some control measures are briefly discussed in the Impact Statement. However, with a total proposed site development of 66 acres, a Water Quality Management permit for soil and erosion control will be required from our Regional Office. The applicant is referred to:

Mr. Richard Zinn, Regional Coordinator
P. O. Box 477
Meadville, Pennsylvania 16335

814-724-4501

Response

Due to precedent permits the above mentioned permit is not required. The need for a responsible soil and erosion control plan is recognized and is discussed in the responses to the comments of the Erie Metropolitan Planning Department.

UNITED STATES DEPARTMENT OF THE INTERIOR
Washington, D. C.

Comment

Soils - from page 1:

As the environmental statement is now organized, the soils of the project area are described in several sections under the broad topic of Environmental Setting Without the Project. We suggest that this information be brought together in the Soils section on page 2-8 or be combined with the geology given on page 2-2.

It appears to us that Reference 2-1 given on page 2-1 does not show that the soils of the project area consist of dune sands and fine sandy loam to loamy fine sand but rather soils of the Dune Sand miscellaneous land type, the Conotton Series, the Ottawa Series, and the Fredon Series. We find that this is substantiated by correlating the Soil Series descriptions of the above mentioned soils in the Soil Survey Report (reference 2-1) with those in Tables 2-11, 2-12 and the discussion on page 2-8 of the statement.

We suggest that consultation in regard to soil types be obtained from Mr. Gerald J. Latshaw, State Soil Scientist, Soil Conservation Service. His address is Federal Building and U.S. Court House, Box 985, Federal Square Station, Harrisburg, Pennsylvania 17108.

We further suggest that a copy of the soil survey interpretative information guide pertaining to outdoor recreation, wildlife and open-space planning be obtained from Mr. Latshaw to assist in the overall recreation plan for the area.

Response

The soils information presented in the Report have been brought together and are presented on page 2-8 under soils.

The soils information as stated above is correct and the Soils section of the report has been revised to reflect this data. Mr. G. J. Latshaw, State Soil Scientist, was contacted and his recommendations were followed as discussed in the soils section.

Comment

Estimated Dredging and Blasting Impact - from page 2:

It is recognized on page 3-1 that damage to eggs and fry can be avoided by dredging at a time of the year when spawning of important species does not take place in the immediate vicinity. We suggest that the Corps of Engineers require the applicant to dredge or blast during December 1 to May 1 and June 15 to September 15 to the extent feasible. This requirement should be reflected in the final environmental statement.

Response

A study of the local aquatic ecology will be conducted and the results will be used to determine the duration of the spawning seasons in the area which will be the basis for the dredging and blasting schedule. Federal and local Fish and Game Agencies will be contacted to coordinate this work.

Comment

Land Use, Recreation, and Historical Sites - from page 2:

The proposed project will not adversely affect any existing or proposed unit of the National Park System, or any known natural or environmental education sites elegible or considered potentially eligible for the National Landmark Programs.

The area should be examined by competent professionals to determine the existence of all cultural resources. An important first step would be consultation of the National Register of Historic Places and with the State Historic Preservation Liaison Officer for identification of any properties listed or elegible for listing in the National Register. If such properties exist, the statement should indicate the steps that are being taken to assure compliance with Section 106 of the National Historic Preservation Act of 1966 (P.L. 89-655) in accordance with the procedures of the Advisory Council on Historic Preservation described in the Federal Register of November 14, 1972. Although a copy of the statement has been sent to the State Liaison Officer for review, it is also advisable that he be contacted during planning stages.

There is no evidence in the statement that a determination was made regarding the presence of cultural (archeological, historic, architectural) resources by direct professional examination. The "old state line marker" is the only such resource mentioned. However, it does not appear that a professional historian was consulted for the purpose of identifying and evaluating this resource. We surmise that the object is a boundary monument. We believe that since cultural resources are important elements of the environment and should receive the interdisciplinary investigation required in NEPA and Executive Order 11593 of May 13, 1971.

The statement also should indicate how cultural resources were considered during project planning, how they will be affected by the developments, how such effects will be mitigated and what effects will be unavoidable. Loss of cultural resources should be considered as irreversible and irretrievable.

Response

The proposed site and specifically the construction area, has been investigated by Dr. B. C. Kent of the Commonwealth of Pennsylvania's Historical and Museum Commission. It has been determined that there exists an archaeological site (Er 57), the area of which intersects the proposed construction site. In order to comply with the National Historic Preservation Act of 1966, (P.L. 89-665) PENELEC has contacted Dr. P. Dragoo of the Carnegie Museum, Anthropological Center as suggested by the Pennsylvania Historical and Museum Commission. PENELEC is negotiating with the Carnegie Museum to have archeaological investigation and salvage work at the site prior to construction. PENELEC will provide financial assistance in this regard.

The State Liaison Officer will be contacted during the detail planning stages of this project.

Mr. H. Freedenburg of the Pennsylvania Museum Commission, Historic Landmarks Office has determined that the "old state line marker" is a boundary marker separating New York State and the Commonwealth of Pennsylvania. This is one of five such markers that exist along this boundary.

The area for the site was selected due to its close proximity to the load center, the availability of water, railroad facilities, and a transmission line, so no new lines would be required. In addition, the site is in an area of very low population density. The low plant silhouette and the existence of wooded areas adjacent to the site provide a natural barrier to the plant interaction with the cultural resources of the area. The physical characteristics of the land are no different than many other areas along the lake.

Comments

Recreation - from page 3:

Several references to recreational facilities in the vicinity of the proposed project are made on pages 2-1, 2-13, 3-19 and 3-20. We suggest that the final environmental statement contain a map indicating existing, authorized and planned recreational facilities in the general vicinity. Also, we think that the final statement should identify and describe the impacts on recreation resources. The environmental impact section on pages 3-19 and 3-20 only restates the list of recreational facilities previously mentioned on page 2-1 and 2-13.

The impact section on page 3-19 should be expanded to include a discussion on the following: (1) disruption of existing access areas as a result of the project, (2) improvement of access areas as a result of the project, (3) impact of the project on fishing opportunities in Lake Erie and Elk Creek, (4) impact of the Corps of Engineers structures on fishing and boating in the project area, (5) identification of the local interests who will develop the mooring facilities (6) the construction schedule for the mooring facilities, (7) how the proposed facilities contribute to the county or State recreational plans.

Response

Maps of the existing, authorized, and planned recreational facilities have been included in Section 2.0 and appear as Figures 2-9 and 2-10.

PENELEC is participating in discussions aimed at improving the recreational facilities in the area. This project will meet water and air quality standards and the intake and outfall is designed to ensure no negative effects on fishing and boating in the area.

There is no recreation type beach at the lakefront of the property. Access to the beach front is very limited. The shoreline is not accessible from the property. The property is mixed woods and farmland. The Tri-County Archery Club has the use of portions of the property for range practice. The Lake Erie Community Park and the Lake City Trailer Park are within two miles of the proposed plant site. There are some year-around residences and some summer cottages near the mouth of Elk Creek. The harbor consists essentially of several natural lagoons with mooring which support small boat activity and fishing in Lake Erie. There is a federally authorized project for a harbor of refuge and a small boat harbor at Elk Creek. This would consist of (Reference 89th Congress, 2nd. Session, House Document No. 512) breakwaters, entrance channels, anchorage basin, and dock channel. The project description foresees breakwater fishing and greatly increased boating and lake fishing. The cooperation of local bodies is expected; however, construction has not yet commenced. The location of the facilities are shown on Figure 2-10 drawings, and the U.S. Army Corps of Engineers plans for the harbor are shown by overlay on the general area at the mouth of Elk Creek.

1. The public will be excluded from access to the plant area and transmission right of way for safety reasons. There is no means of access available at this time.

2. The improvement of access areas is being discussed with local authorities but no firm plan exists as yet. This is discussed below.

3. See the comments of the Metropolitan Erie Planning Board for data related to impact of construction activities. The combined cycle plant with a cooling tower and a diffuser outfall yields a very small mixing zone as shown on Figure 1-6. Any impact will be confined to the immediate area of the outfall.

The plans are incomplete for the Corps of Engineers' Elk Creek Marina Project at this date. A separate environmental impact statement will be written at a later date to cover this project.

Comment

Protective Measures - from page 3:

It is indicated on page 3-20 that the public will be excluded from the plant site. We do not think that excluding people from the site is in the best interest of the general public.

We suggest that the entire 639-acre site and associated transmission rights-of-way should be managed for public use to the extent practical without conflicting with the primary purpose of the project. Beneficial uses such as picnicking, nature study, or small game hunting should be considered. We suggest that a fish and wildlife management and public use plan should be developed by the applicant in cooperation with the Pennsylvania Fish Commission, the Pennsylvania Game Commission, the Bureau of Sport Fisheries and Wildlife, the Bureau of Outdoor Recreation, both of this Department. If feasible this plan should be described in the final environmental statement, otherwise the final statement should indicate that such a plan will be developed.

Response

PENELEC recognizes the need for a fish and wild life management and public use plan for the area. Preliminary discussions between state and local authorities on this subject are underway and although no definitive plan has been reached, that can be reported, a plan of this type will be established for this site. Specific areas under discussion for the recreation plan are as follows:

a. Development of recreational facilities at the Lake City site has been explored with Erie County Commissioners, the Pennsylvania Fish Commission, and the Girard Township supervisors.

b. The County and Commonwealth's goal is to develop a major marina and adjunct recreational facility. Agreement was reached that PENELEC will cooperate with these governmental agencies in their major project which they are developing at the mouth of Elk Creek. This cooperation will include providing land on the west side of the Creek, that will be used in conjunction with land already state owned on the east side for this program. Development of this area will include fishing and picnic facilities and participation in such other activities as are agreed upon after completion of detailed plans.

c. At the suggestion of local authorities, PENELEC has agreed to illuminate and locate its elevated water tower so that it will serve as a guide for boaters on Lake Erie.

Comment

Appendix B - from page 4:

Based on plant requirements given in Appendix B, it appears that the lake surface temperature will not rise more than 2 degrees F. The dilution factor theory given on page B-4 is dependent on the theory of submerged jets, which is presently somewhat questionable since there is considerable disagreement on how to define the physical limits of a submerged jet discharging into a still body of water. However, the amount of heated water to be discharged is quite small in comparison to the volume of the receiving water body.

Response

The thermal diffuser was designed using currently accepted references (Reference Browns Ferry Nuclear Plant, Internal Hydraulics of the Cooling Water Diffuser. Advance Report No. 10 TVA Report No. 63-23). Also, the very small amount of discharge should not cause any harm to the environment as pointed out by the reviewer.

COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA FISH COMMISSION
Harrisburg, Pennsylvania

Comment

Review Function - from page 1:

Since the Pennsylvania Fish Commission has jurisdiction over the fisheries in Lake Erie and the other waters of the Commonwealth, this is certainly within our area of concern, although the Department of Environmental Resources has replied to the effect on fisheries, using as examples the present problems created by the discharge line of the Pennsylvania Electric Company's generating plant on the shores of Erie Bay. There are heavy fish kills of gizzard shad and emerald shiners resulting from changes in temperatures, and the purpose of this letter is to determine whether the Pennsylvania Fish Commission will have a review function in the application for the permit.

Response

The Pennsylvania Fish Commission and other concerned groups have a review function during the issue of public notice of the application and a review of the Draft Environmental Impact Statement.

Comment

Heated Effluent - from page 1:

At the same time, since we are cooperating with your office in the reactivation of the Elk Creek Harbor Project, our own engineers have put forth an informal suggestion that the possibilities of using somewhat warmer waters to keep the harbor refuge free of ice might be a feasible use of these discharges.

Response

The proposed outfall has been designed to promote quick dillution to minimize any thermal effect. It is located to insure that a heated field will not block fish from moving in and out of Elk Creek. It is felt that the present design offers the least amount of environmental impact.

FEDERAL POWER COMMISSION
Washington, D. C.

Comment

From page 4:

The staff of the Bureau of Power concludes that the electric power output represented by the Lake City plant is needed to meet GPU's projected system loads and reserve margin requirements.

Response

No response is deemed necessary.

8.3 UNRECONCILED CONFLICTS

There are no unreconciled comments.

8.4 CORRESPONDENCE

Copies of all correspondence received from the agencies listed in Paragraph 8.2 concerning their comments on the Draft Environmental Statement for Lake City Station are as follows:

ERIE METROPOLITAN PLANNING DEPARTMENT

ERIE COUNTY COMMUNITY SERVICES CENTER
606 WEST 2nd STREET
ERIE, PENNSYLVANIA 16507
(814) 456-6590

.ISTOPHER CAPOTIS, AIP
Planning Director

February 20, 1973

Colonel Robert L. Moore
Corps of Engineers
District Engineer
1776 Niagara Street
Buffalo, New York 14207

RE: Draft Environmental Impact
Statement
Lake City Station
Pennsylvania Electric Company

Dear Colonel Moore:

Thank you for your letter of January 29, 1973, transmitting the above captioned statement to this office for the purpose of review and comment. Below, please find our response.

A. General comments concerning the proposed project:

Energy source - This 250 mw Power Plant will use a low sulfur (.5%) No. 2ASTM Fuel Oil as its prime energy source. Based upon data supplied the facility will use some 61 million gallons, or 1.45 million barrels of this fuel per year. Over the project's 30 year life span, 1,833 billion gallons would be required. We highlight these figures to point out that the facility will have relatively high demand of low sulfur fuel oil - an energy source apparently in limited supply. Current inquiries into the Erie Market Area indicates that fuel oil is currently being informally rationed by some companies. In addition we note that fuel oil shortages are evident in other areas this year, the Metropolitan New York Area being the most noteworthy example.

In addition to the fuel oil energy source, two other alternate base energies were discussed in a cursory fashion by this report, coal and nuclear. Although neither were regarded as currently feasible due to the location and purpose of the station (i.e. intermediate rather than base load) this office cannot dismiss them as changes in relative fuel cost, or annual hours of operation can change the relative economic attractiveness of three options (Note chart of fiture 5-2 which seems to indicate that an increase of 20% of anticipated annual operation for this facility may make nuclear production attractive.)

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We bring up these points to point out that the potential of a conversion of this station of other energy modes (or variations of other grades of oil) in the future must be considered as within the laws of relative probability. If such conversions are considered likely they may coincide with the estimated 24,000 hours of operations (roughly 6 years) overhaul schedule. If such an energy mode conversion is proposed in the future, it must be considered as a viable possibility and should not be considered as an unexpected "crises" type of problem. Any energy conversion must receive the same methodical investigation that the current facility is receiving.

B. Specific Comments

Soil erosion and sediment control - Because over 25 acres of earth clearance is contemplated, an erosion and sediment control plan may be required under current DER criteria. The Erie County Health Department should be consulted on this point. In any event, this office most emphatically recommends that Penelec and its contractor consult with the Erie County Soil Conservation District/SCS (United States Department of Agriculture) for the preparation of proper soil management and drainage practices during and after construction.

Water Effluent - According to the Statement water effluent will meet both thermal and other DER Standards. This office notes the waste water from the demineralization process will be mixed with the cooling tower blow down and other water wastes to obtain permissible limits. Because the demineralized waste represents the most constant potential pollutant (outside of possible oil problems), it should have a fail-safe method of handling. In addition, we recommend a monitoring of water effluent at discharge points to determine that the proper thermal dispersion is occurring.

Air Pollution - The plant will be within 1 1/2 to 2 miles of significantly populated areas of Lake City. Because westerly winds are quite common locally, especially in summer months, emmissions from the plant may present problems even if they are within EPA/DER standards. Beyond that point this office notes all air pollution extrapulations are based upon nominal plant operations. Recently in New York fuel shortages caused high sulfur fuel to be used. Such a local contingency may arise and a plan to offset any adverse results should be devised.

One final note of this review would be the need for man and his energy sources to be compatible. Penelec should be commended upon their efforts to minimize adverse affects of this facility. However, even this non-technical review indicates that such a task is indeed difficult. This office may suggest that if the increasing use of energy cannot exist without producing deleterious effects for man and his environment then some rational method to limit or ration energy forms must be devised and followed.

We trust our remarks will be os some assistance to you in your consideration of this proposal.

Sincerely,

Christopher Capotis
Executive Director

CC/lo

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

EASTERN REGION
FEDERAL BUILDING
JOHN F. KENNEDY INTERNATIONAL AIRPORT
JAMAICA NEW YORK 11430

8 March 1973

Col. Robert L. Moore
Corps of Engineers, District Engineer
Department of the Army
Buffalo District
1776 Niagara Street
Buffalo, New York 14207

Dear Col. Moore:

In reply to your letter of 29 January 1973, NCBED-PF, we have reviewed the Draft Environmental Statement regarding the Lake City Station, Unit 1, Pennsylvania Electric Company, and wish to advise that we have no comments on this project.

Sincerely,

Walter D. Kies
WALTER D. KIES
Chief, Planning Staff

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THE ASSISTANT S RETARY OF COMMERCE
Washington, D.C. 20230

March 19, 1973

Colonel Robert L. Moore
District Engineer
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Dear Colonel Moore:

The draft environmental impact statement for the proposed electric power plant on Elk Creek near Lake City, Erie County, Pennsylvania, which accompanied your letter of January 29, 1973, has been received by the Department of Commerce for review and comment.

The Department of Commerce has reviewed the draft environmental statement and has the following comments to offer for your consideration.

Inspection of the draft environmental impact statement reveals a number of apparent conceptual errors which could eventually lead to unfortunate operational difficulties as well as to possible unnecessary adverse impacts upon the environment. The conceptual errors to be discussed can best be summarized by extracting the last four lines of paragraph B.1.1 of Appendix B of this draft environmental statement., "... Lake Erie, because of its size and depth, (second smallest of the Great Lakes and with an average depth of 58 feet - 210 feet maximum depth) may be treated more as an ocean than as a lake or inland reservoir." Lake Erie can not be treated more as an ocean than as a lake. To the contrary,

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one could regard the west, central and east basins of Lake Erie as separate but interconnecting lakes, each with different physical, chemical and biological characteristics. Each basin has a separate and distinct circulation pattern as well as a separate and distinct thermal regime. The west basin which is the most shallow and turbid of the three basins has its eastern most boundary formed by the Point Pelee - Lake Erie Islands complex. The eastern boundary of the central basin is formed by a sand and gravel reef extending across the lake just west of Erie, Pennsylvania. The proposed power plant which is the subject of this draft environmental statement is located at the extreme eastern end of the central basin of Lake Erie.

A conceptual error is committed in paragraph 2.5.1 Present Water Quality and Use, by making reference only to "present water quality" rather than making reference to seasonal, short term and long term ranges in concentration of the various chemical and physical parameters listed on page 2-7. Furthermore, the report fails to state when the samples analyzed were collected and whether the figures shown in the table are the result of analysis of one sample from one site, the average of a sample or samples taken at the three points mentioned or if it is the result of analysis of combined samples.

An error of omission is made in paragraph 2.5.1 by leaving out completely any discussion of water use. This is a serious omission as paragraph 1.3.1.1 Demand/Supply Forecast, points out that maximum power plant usage will occur during the peak power demand summer months. This, of course, is the same time that peak recreational water and land use occur and when the most serious water quality problems occur. In paragraph 2.6.1 Physical-Chemical Characteristics, an error is made by implying that physical-chemical characteristics of the water at the city of Erie intake are comparable to physical-chemical characteristics at the proposed power plant intake site. The proposed

power plant intake is less than two thousand feet off-shore in the central basin of Lake Erie. The Erie, Pennsylvania intake is 6000 feet off Presque Isle which itself juts out several thousand feet from the mainland shore and it is located in the eastern basin. The nearest intake in the central basin most similar to the proposed intake is located at Conneaut, Ohio and should be used as the standard for comparison. The Conneaut intake is 13 feet below low water datum. Because the Erie and Conneaut water intakes are located in different basins, fundamental differences in water quality are apparent. Intrusion of the hypolimnion at the Conneaut intake and along the south shore of the central basin is more severe than it is at the Erie intake because of the hydrography. This condition is apparent from inspection of records of such parameters as dissolved oxygen and water temperature. Since a temporary increase in dissolved solids and hardness is generally associated with hypolimnion water, intrusion of the hypolimnion could cause a decrease in efficiency of the cooling tower operation.

Turbidity may be much higher at the proposed intake than 5 JTU indicated in the statement. Formation of a thermal bar in early spring causes highly turbid run-off to be held in a circulation cell along shore. Turbidity is also elevated due to resuspension of bottom material by wave action. At Conneaut, Ohio intake in 1970, turbidity was greater than 5 JTV most of the time and 10 JTV or greater about one third of the time.

Dissolved solids in Lake Erie have been rising sharply since about 1910 and will continue to rise in the foreseeable future. At what point dissolved and total solids will become a serious operational problem as far as cooling tower efficiency is concerned is not made clear in the statement. It should be noted however that total solids are sharply variable on a short term basis and have been recorded at a concentration as high as 416 ppm at Conneaut intake on July 7, 1970.

There is no assessment of the cooling tower impact upon the environment in this report. This again is a rather serious omission. A discussion of atmospheric effects caused by cooling tower operation in the near shore area of Lake Erie is in order. What would be the result of cooling tower operation during a "lake effect" snow storm? What effect will cooling tower operation have during temperature inversion periods?

Other questions arise regarding the selection of a power plant which requires high quality, low sulfur fuel oil which is likely to be high priced and in critically short supply for some time to come.

One must question the selection of a site for power plant construction adjacent to the last remaining portion of the south shore of central Lake Erie where body contact water recreation is still a viable activity. Hundreds of thousands of persons travel to this area annually during the period June thru August to spend millions of dollars on land and water recreation.

From the discussion in Appendix A of the subject document, it is unclear what has been computed in the case of "maximum 3 hour SO_2 ground level concentration" as is shown in exhibits A-11 and A-12. Is this an average 3-hour maximum or is this a discrete event maximum? The governing air quality standards (exhibit A-9) clearly state with regard to the three hour value that "the maximum three hour SO_2 concentration not to be exceeded more than once per year is 1300 micrograms per cubic meter". Thus, in comparison, what should be computed is the maximum credible 3-hour event that could occur at least once a year. In our view, this maximum event would occur under what is called downwash conditions using the third equation on page A-3 where the average indicates a 3-hour average. A very graphic smoke plume photograph of this condition is shown in figure 3.20 of the publication "Meteorology and Atomic Energy, 1968" (Clearinghouse for Federal Scientific and Technical Information, TID-24190). The building in the photograph is similar in size and shape to the Lake City Station, even to the 4 short stacks above the roof. The Lake City Unit is described as having stacks at a

height of 85 feet with a building height of 65 feet. Thus the stacks are 20 feet above the roof and within the building wake.

Using the equation on page A-3 and assuming neutral conditions (Pasquill Type D), a wind speed of 2 m/sec, a mixing layer of 40 m, and a SO_2 source term of 147 grams/sec (exhibit A-4) we compute a concentration of 10,000 micrograms per cubic meter at a distance of 1 km downwind for a 15-min average concentration. Extending the 15-min average to a 3-hr. average by the use of table 5-1 of reference A-1, the concentration becomes 6000 micrograms per cubic meter. The same value can be obtained using the equation IV-8 of reference A-4 with a building cross section of 20 x 60 meters and a c factor of 1/2.

In summary, we compute a maximum 3-hour SO_2 ground concentration of 6000 micrograms per cubic meter which is about 40 times greater than in exhibit A-12 and also above the National Secondary Ambient Air Quality Standards. The meteorological parameters we have assumed are not an infrequent occurrence.

We hope these comments will be of assistance to you in the preparation of the final statement.

Sincerely,

Sidney R. Galler

Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

22c

Erie County Department of Health

Phone 814/454-5811

606 West Second Street
ERIE, PENNSYLVANIA 16507

March 20, 1973

Robert L. Moore
Colonel, Corps of Engineers
Department of the Army
Buffalo District
1776 Niagara Street
Buffalo, New York 14207

Re: Environmental Impact Statement
Proposal
Penelec Plant
Lake City
Erie County

Dear Colonel Moore:

This office has completed review of Pennsylvania Electric Company's draft Environmental Impact statement for their proposed power plant on Lake Erie. This plant will be located near the mouth of Elk Creek in Erie County.

With the exception of a few specific points, this office would like to make the general comment that the study is not decisive enough in its statements. Throughout the study one repeatedly sees phrases such as "might", "may have," "probably", etc. These statements are not specific enough and this office recommends that definite statements be made as to any harmful environmental effects expected from the project.

In our review, the following specific questions came to mind. First, it was noted that macroinvertebrate data was not gathered from the area in question. This office recommends that sediment analysis be made to gather the information from the local area. Secondly, does any fish spawning take place within the 1° mixing zone? If so, what effect will the thermal discharge have on this activity? Also, this office would like to suggest that some form of mechanical screen cleaning might be wise on the intake pipe. Algae conditions can become severe in late summer and some difficulty may be encountered from this algae building up on the screen.

Based on the information submitted and our knowledge of the area, we

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believe that the proposed discharge will have minimal or no adverse effects on the surrounding water quality. However, we do believe that the above information should be gathered, not only to further support their position but to enable the area to be monitored after installation of their facilities.

Very truly yours,

Gerald C. Allender, P.E.
Director
Division of Sanitary Engineering

GCA/ew

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
6TH AND WALNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

March 26, 1973

Colonel Robert L. Moore
District Engineer
U.S. Army Corps of Engineers
Buffalo, New York 14207

Re: Draft Environmental Statement, Lake City Station, Unit 1, Erie County, Pennsylvania

Dear Colonel Moore:

We have completed our review of the draft EIS, subject above, and wish to make the following comments.

We have been unable to verify the results of the applicant's modeling effort because Appendix A, "Evaluation of Stack Emissions And Dispersion Analysis" is incomplete. Errors have been discovered in formulas A-1, A-3 and the downwash formula. Terms have been improperly defined, e.g., the plume rise for various conditions. Are these averaged plume rises under many conditions, or was one calculation of plume rise made for an average condition? We suggest that Appendix A of the EIS be completely rewritten following the suggestions in Attachment 1, "Guideline Checklist For Evaluation of Fossil Fuel Power Plant Impact on Air Quality".

The draft fails to discuss CO emissions and the use of metals in the fuel (especially manganese), either currently or in the future, in order to reduce the opacity of emissions. It further neglects to discuss guarantees that a more polluting fuel will not be used in the future. (Page 5-5 indicates that a capability exists for burning No. 6 or crude fuel oil.)

We invite your attention to the fact that Standards for gas turbines are due to be proposed by EPA in the near future. These Standards will probably limit emissions approximately to the levels permitted for new boilers - this source would exceed such a NO_x Standard severalfold.

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Exhibits A-3 illustrates that the project will be a significant source of NO_x. It is not clear how the low NO_x emissions from the waste heat boilers (p. A-3) will be achieved. There are currently available methods to control NO_x emissions from gas turbines.

The discussion of alternatives should emphasize techniques for reduction of emissions and modifications in the location and design of cooling water intake and discharge structures. (See below.)

The draft states that the cooling water intake structure will have a vertical approach velocity. We submit that a horizontal approach velocity might be preferable. This is indicated in a technical paper entitled "Application of Mechanical Systems to Alleviation of Intake Entrapment Problems" by H.S. Riesbol and P.J.L. Gear. This report was presented at a conference entitled, "The Engineering Aspects of Siting and Operating Power Plants" in Washington, D.C., February 13-14, 1973 and states:

"The velocity cap over the mouth of a vertical submerged bellmouth intake was found in some tests to reduce greatly the rate at which fish were drawn into the intake. It does not however eliminate the problem. This modification, which provides a horizontal approach flow into the bellmouth, was developed after fish had been observed to react to horizontal velocity changes while remaining largely oblivious of vertical velocities. The velocity cap is used on most of the offshore intakes in the Los Angeles area (3). A section of a typical installation is shown on Figure 2."

Figure 2 "Offshore Intake With Velocity Cap" of this report is attached to our comments.

This report also observes that it can be quite important to locate the intake away from areas where fish would naturally congregate. The following paragraphs convey this point:

"The siting of the intake can have a marked influence on the quantity of fish drawn in with the diverted water. To reiterate what is considered to be one of the most important factors in alleviating entrapment problems, this influence of the ambient fish and their behavior must be given its proper weighting and consideration during the siting and positioning of intakes.

Provided the biological, ecological and natural flow surveys are completed in time, it is possible greatly to reduce the entrapment problem by locating and orientating the intake to divert water from an area of low natural fish population. It should be noted that the fish regime adjacent to a plant can be materially changed by its operation, and any tendency to recirculation of heated water could be expected to aggravate a fish problem through the apparently usual attractiveness to fish of the warmer water. There is thus an added objective in ensuring the operational separation between intake and outlet."

The final EIS should describe to what extent the siting of the intake (for the proposed plant) will take into account such factors.

A related potential problem is the stagnation of heated water in the vicinity of the plant. We gather from the EIS that currents are not consistent and uniform. We wish to know how often such currents will fail to promptly remove the heated water from the plant vicinity. What conditions could lead to such stagnation? How often might they occur? For how long a duration? How large would the resulting area of raised temperatures be and how hot? We are concerned that such stagnation might a) block fish from near-shore areas utilized during various times of year or b) attract fish to the vicinity of the intake with resultant losses through impingement.

We note further that during the winter the plume of heated water may be expected to sink. What effect will this have on the distribution of excess temperature, recirculation and on the attraction of fish to the vicinity of the discharge (or intake)?

We would like to see the possibility of load shape modification by changes in the prices charged for peak versus non-peak power discussed as an alternative to the Lake City station. The following questions amont others, should be addressed: 1.) What prices are charged for peak (or intermediate) and non-peak power to different categories of customers, i.e., residential, commercial and industrial? 2.) How elastic are the peak power demands of these various users? Discuss the elasticity over different time periods: one year, five years, ten years. 3.) How does the price charged for peak power compare with the marginal generating cost in each case?

We do not suppose that price changes, even if desirable in their own right, could modify the hourly demand curve soon enough to obviate the need for the Lake City station. However, the timing to future units might well be affected. Moreover, the resulting changes in the demand over time might make it possible to operate the proposed unit more in the combined cycle mode and less in the pure gas turbine mode. This shift would provide savings in fuel combustion and air pollutants emitted.

In summary, we regard economic actions to be major available non-structural alternatives to various aspects of the construction and operation of generating plants. We expect to see such non-structural alternatives comprehensively explored in the EIS.

Weakening of the ice by heated water might possibly cause a safety hazard to fishermen exploiting the attraction of fish to the heated plume in winter. What safety precautions would be exercised by the applicant?

The final EIS should indicate what provision will be made to monitor:

1. The thermal plume, especially if stagnation occurs,

2. Potential fishkills resulting from entrapment and other entrainment losses,

3. Discharges of oil or other chemicals, deliberate or accidental. (If biocides are used to control fouling, will these toxic materials be present in the discharges?)

The statement should expand its Spill Prevention, Containment and Countermeasure (SPCC) Plan if that is what Items C1.3, C1.3.1, C1.3.2 and C1.3.3 in appendix "C" are intended to be. These items are inadequate from the standpoint of EPA's standards and may not fulfill Pennsylvania's requirements for a Pollution Incident Prevention Plan. This facility will receive No. 2 fuel oil by either tank truck or tank car, and also use sulfuric acid, sodium hydroxide, ammonia and possibly PCB in their transformers. Spills of any of these materials could certainly harm the receiving waters and we believe Pennsylvania Electric should supply a comprehensive plan. Such a plan shall include information and procedures relative to the prevention of spills and hazardous substances including:

a.) A description of the reporting system which will be used to alert responsible facility management and appropriate legal authorities.

b.) A description of preventive facilities (including overall facility plot) which prevent, contain or treat spills and unplanned discharges.

c.) A list of all oil and hazardous materials used, processed or stored at the facility which may be permitted into the permitted discharge.

Proposed effluent conditions submitted apparently meet both Federal and State requirements. However, this project will require an EPA discharge permit under Section 402 of P.L. 92-500 and state certification under Section 401 of this law, as well as a Section 10 Permit for work in navigable waters. It is noted that damage to fish eggs and fry can be avoided by dredging when spawning of important fish species does not take place in the project vicinity. The specifics of the schedule should be described in the final EIS. Since a significant amount of excavation will be done utilizing explosives, we recommend coordination of this aspect with appropriate Federal and State Fish and Game Agencies.

It is stated that raw sewage from the plant is collected in a septic tank; however, no information is given on its design or the possibility of its seepage into the two bodies of water adjacent to the plant.

We have reported this review in EPA Reporting Category ER-2, i.e., EPA has reservations concerning the environmental effects of certain aspects of the proposed action and believes that the draft does not contain sufficient information to assess fully the environmental impact of the proposed project. The classification and date of EPA's comments will be published in the Federal Register in accordance with our responsibility to inform the public of our views on proposed actions under Section 309 of the Clean Air Act.

Sincerely yours,

Robert J. Blanco

Robert J. Blanco, P.E.
Chief
Environmental Impact Branch

Attachments

be given and the variation of the parameters between the measurement locations and the plant site should be estimated. In order to predict the long-term effect of the plant on the air quality, a rather complete diffusion climatology will need to be prepared.

The task of estimating the effect of a new fossil fuel power plant on air quality is not at all an easy one. The analysis of the data and the judgements to be made require the expertise of a professional meteorologist. With the proper personnel and an adequate data base, a fair and honest appraisal of the effect of a proposed source of pollutant on the air quality can be made and evaluated.

ENVIRONMENTAL PROTECTION AGENCY

November 2, 1972

GUIDELINE CHECKLIST FOR EVALUATION OF FOSSIL FUEL POWER PLANT IMPACT ON AIR QUALITY

Fossil fuel power plants are frequently the largest sources of sulfur dioxide in a region. As such, their impact on air quality must be evaluated carefully and completely. This guideline considers a number of parameters which should be covered in an evaluation, including Environmental Impact Statements, of the air quality impact of a proposed fossil fuel power plant.

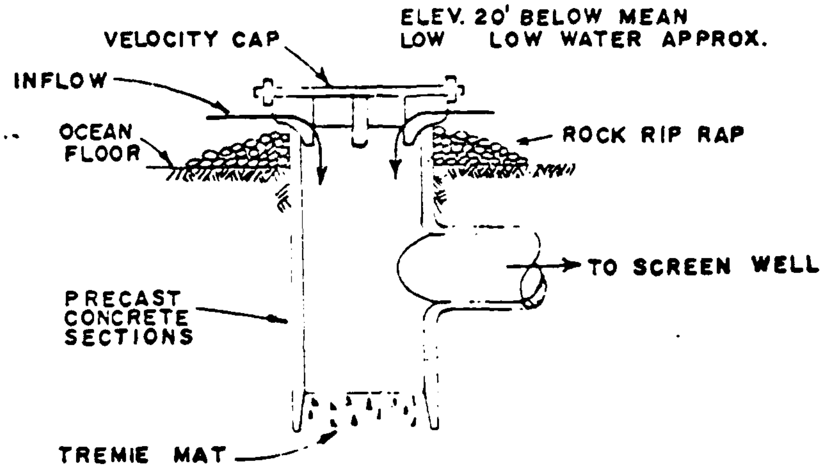
1. Effective Stack Height - The effective stack height is the sum of the actual height of the stack and the plume rise. The height of the stack should be given. The plume rise can be calculated from a number of equations given in the literature. Among those in use now are equations given by Briggs (1970) and by Moses & Kraimer (1971). Besides the result of plume rise calculations, the impact evaluation should list the exit velocity of the gas from the stack, the exit temperature of the gas, the internal diameter of the stack at its top, and the heat content of the gas being released. The plume rise formulas used should be listed and an example calculation should be given.

2. Short-Term Air Quality - Calculations of ambient air quality should be made for sulfur dioxide, particulates, and oxides of nitrogen. The short-term calculations should consider the worst hour in any one year that can be expected from the plant, the worst 24 hours that can be expected from the plant, and the concentrations that can be expected under fumigation conditions.

3. Long-Term Effects - The impact analysis should also consider the effect of a plant on the seasonal and annual air quality in the area.

In estimating short and long-term air pollution concentrations, the evaluation should take into account the presence of other sources of pollution in the area of the plant, the effects of the terrain on the air quality, the centers of population near the plant, the applicable air quality standards, the existing air quality in the area of the plant, and with regard to the air quality standards, availability of air resources for future growth in the vicinity of the plant.

To be adequately evaluated, the analysis on air quality must give all the data that is used in the analysis, and the formulas used, including literature references and derivations. Where a new model not given previously in the literature is used, validation of that model on independent data must be demonstrated. Meteorological data will also have to be used in doing this analysis. The source of that data must



SECTION

OFFSHORE INTAKE WITH VELOCITY CAP

FIGURE 2

CC

COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF ENVIRONMENTAL RESOURCES
P. O. BOX 1467
HARRISBURG, PENNSYLVANIA 17120

Secretary

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APR 1 2 1973
OFFICE OF STATE PLANNING AND DEVELOPMENT

April 2, 1973

SUBJECT: Department of Environmental Resources Review and Evaluation of
SCH No.: 73-02-3-002
Title: Draft Environmental Statement Lake City Station Unit 1

TO: Mr. R. A. Heiss, Coordinator
State Clearing House

FROM: MAURICE K. GODDARD
Secretary of Environmental Resources

The aforementioned has been reviewed by all of the appropriate personnel in the Department through our DER Clearing House.

Submitted Draft E.I.S. for the proposed project is granted clearance on condition that the requirements mentioned in the attached REVIEW AND EVALUATION REPORT, are met.

This evaluation is based strictly on the data submitted and actions as proposed. Approval does not extend automatically to any changes considered minor or to the time framework as proposed. A re-evaluation of any such changes will be necessary as soon as data can be submitted by the applicant. This information should be submitted by the applicant directly to the State Clearing House.

Throughout the duration of the review and evaluation, our DER Clearing House is ready to provide any assistance to facilitate progress of this undertaking.

DEPARTMENT OF ENVIRONMENTAL RESOURCES

SUMMARY OF REVIEW AND EVALUATION

WARNING: The information provided here is for use only with the accompanying memorandum, signed by the Secretary, Department of Environmental Resources. Under no circumstances is it to be released separately to any applicant or agency.

SCH Number: 73-02-3-002 TITLE: Lake City Station # 1

DATE: 4-2-73 LOCATION: Lake City, Erie County

ADDITIONAL DATA NEEDED

ENVIRONMENTAL IMPACT STATEMENT

___ A. Not applicable to this project.

___ B. An EIS must be submitted for this project, as soon as possible.

PERMIT REQUIREMENTS

___ A. Not applicable to this project.

___ B. Following permits will be required from:

1.
2.
3.

TECHNICAL COMMENTS:

We have completed our review of the Draft Environmental Impact Statement submitted by the U.S. Army Engineer District, Buffalo, N. Y., on the proposed Pennsylvania Electric Company Lake City electric power plant to be located in Girard Twp., Erie County. According to the Environmental Statement, all environmental effects are within the limits of State and Federal standards and there is no local opposition to the power plant.

A Department of Environmental Resources, Water Quality Management Industrial Wastes Permit No. 2572205 was issued on December 8, 1972, for this proposed facility. The Impact Statement was reviewed concerning the proposed industrial waste treatment units and diffuser outfall into Lake Erie. The Impact Statement is generally in agreement with previous data and information submitted to the Department of Environmental Resources by the Pennsylvania Electric Company for the Lake City Station.

Several areas of comment concerning the diffuser outfall do exist. They are as follows:

1. The impact statement proposed a 1400 ft. long outfall compared to a proposed outfall of approximately 1850 feet long permitted by Water Quality Management permit No. 2572205. Subsequent contact with the Company's consultant engineer on this showed that the 1850 feet length was specified using maps of the area. Since then, an actual site survey indicated that the minimum depth need for adequate heat dispersion could be attained 1400 feet from shore. This is acceptable to the Bureau of Water Quality Management.

2. The impact statement specifies a diffuser of 24 inches diameter, 80 feet long for one unit. Data submitted for Water Quality permit specified a 16 inch diameter 80 feet long diffuser for one unit and 24 inch diameter 160 feet long diffuser for two units. The diffuser for one unit will now be installed at a 24 inch diameter 80 feet long accommodating the future installation of a second unit. This is acceptable to the Bureau of Water Quality Management.

The permittee will be requested to submit as built plans of the outfall and diffuser.

One other point of comment concerns soil and erosion control during contruction of the facility. Some control measures are briefly discussed in the Impact Statement. However, with a total proposed site development of 66 acres, a Water Quality Management permit for soil and erosion control will be required from our Regional Office. The applicant is referred to:

Mr. Richard Zinn, Regional Coordinator
P.O. Box 477
Meadville, Penna. 16335

(814) 724-4501

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

In reply refer to:
PEP ER-73/182

MAY 4 1973

Dear Colonel Moore:

This is in response to your letter of January 29, 1973, requesting our comments on the Corps of Engineers' draft statement, dated January 5, 1973, on environmental considerations for Lake City Station, Unit 1, Erie County, Pennsylvania.

Our comments are presented according to the format of the statement or according to specific subjects.

Soils

As the environmental statement is now organized, the soils of the project area are described in several sections under the broad topic of Environmental Setting Without the Project. We suggest that this information be brought together in the Soils section on page 2-8 or be combined with the geology given on page 2-2.

It appears to us that Reference 2-1 given on page 2-1 does not show that the soils of the project area consist of dune sands and fine sandy loam to loamy fine sand but rather soils of the Dune Sand miscellaneous land type, the Conotton Series, the Ottawa Series, and the Fredon Series. We find that this is substantiated by correlating the Soil Series descriptions of the above mentioned soils in the Soil Survey Report (reference 2-1) with those in Tables 2-11, 2-12 and the discussion on page 2-8 of the statement.

We suggest that consultation in regard to soil types be obtained from Mr. Gerald J. Latshaw, State Soil Scientist, Soil Conservation Service. His address is Federal Building and U.S. Court House, Box 985, Federal Square Station, Harrisburg, Pennsylvania 17108.

We further suggest that a copy ofthe soil survey interpretative information guide pertaining to outdoor recreation, wildlife and open-space planning be obtained from Mr. Latshaw to assist in the overall recreation plan for the area.

Estimated Dredging and Blasting Impact

It is recognized on page 3-1 that damage to eggs and fry can be avoided by dredging at a time of the year when spawning of important species does not take place in the immediate vicinity. We suggest that the Corps of Engineers require the applicant to dredge or blast during December 1 to May 1 and June 15 to September 15 to the extent feasible. This requirement should be reflected in the final environmental statement.

Land Use, Recreation and Historical Sites

The proposed project will not adversely affect any existing or proposed unit of the National Park System, or any known natural or environmental education sites eligible or considered potentially eligible for the National Landmark Programs.

The area should be examined by competent professionals to determine the existence of all cultural resources. An important first step would be consultation of the National Register of Historic Places and with the State Historic Preservation Liaison Officer for identification of any properties listed or eligible for listing in the National Register. If such properties exist, the statement should indicate the steps that are being taken to assure compliance with Section 106 of the National Historic Preservation Act of 1966 (P.L. 89-665) in accordance with the procedures of the Advisory Council on Historic Preservation described in the Federal Register of November 14, 1972. Although a copy of the statement has been sent to the State Liaison Officer for review, it is also advisable that he be contacted during planning stages.

There is no evidence in the statement that a determination was made regarding the presence of cultural (archeological, historic, architectural) resources by direct professional examination. The "old state line marker" is the only such resource mentioned. However, it does not appear that a

professional historian was consulted for the purpose of identifying and evaluating this resource. We surmise that the object is a boundary monument. We believe that since cultural resources are important elements of the environment and should receive the interdisciplinary investigation required in NEPA and Executive Order 11593 of May 13, 1971.

The statement also should indicate how cultural resources were considered during project planning, how they will be affected by the developments, how such effects will be mitigated and what effects will be unavoidable. Loss of cultural resources should be considered as irreversible and irretrievable.

Recreation

Several references to recreational facilities in the vicinity of the proposed project are made on pages 2-1, 2-13; 3-19 and 3-20. We suggest that the final environmental statement contain a map indicating existing, authorized and planned recreational facilities in the general vicinity.

Also, we think that the final statement should identify and describe the impacts on recreation resources. The environmental impact section on pages 3-19 and 3-20 only restates the list of recreational facilities previously mentioned on page 2-1 and 2-13.

The impact section on page 3-19 should be expanded to include a discussion on the following: (1) disruption of existing access areas as a result of the project, (2) improvement of access areas as a result of the project, (3) impact of the project on fishing opportunities in Lake Erie and Elk Creek, (4) impact of the Corps of Engineers structures on fishing and boating in the project area, (5) identification of the local interests who will develop the mooring facilities, (6) the construction schedule for the mooring facilities, (7) how the proposed facilities contribute to the county or State recreational plans.

Protective Measures

It is indicated on page 3-20 that the public will be excluded from the plant site. We do not think that excluding people from the site is in the best interest of the general public.

We suggest that the entire 639-acre site and associated transmission rights-of-way should be managed for public use to the extent practical without conflicting with the primary purpose of the project. Beneficial uses such as picnicking, nature study, or small game hunting should be considered. We suggest that a fish and wildlife management and public use plan should be developed by the applicant in cooperation with the Pennsylvania Fish Commission, the Pennsylvania Game Commission, the Bureau of Sport Fisheries and Wildlife, the Bureau of Outdoor Recreation, both of this Department. If feasible this plan should be described in the final environmental statement, otherwise the final statement should indicate that such a plan will be developed.

Appendix B

Based on plant requirements given in Appendix B, it appears that the lake surface temperature will not rise more than 2 degrees F. The dilution factor theory given on page B-4 is dependent on the theory of submerged jets, which is presently somewhat questionable since there is considerable disagreement on how to define the physical limits of a submerged jet discharging into a still body of water. However, the amount of heated water to be discharged is quite small in comparison to the volume of the receiving water body.

We hope these comments will be helpful to you in the preparation of the final environmental statement.

Sincerely yours,

Assistant Secretary of the Interior

Colonel Robert L. Moore
District Engineer
Corps of Engineers
Department of the Army
1776 Niagara Street
Buffalo, New York 14207

COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA FISH COMMISSION
HARRISBURG 17120

EXECUTIVE DIRECTOR

May 7, 1973

Col. Robert L. Moore
District Engineer
U. S. Army Corps of Engineers
Buffalo District
1776 Niagara Street
Buffalo, New York 14207

Dear Col. Moore:

The Department of Environmental Resources, Bureau of Litigation, sent us a copy of your "Revised Public Notice" dated 2 February 1973 related to the proposed intake and discharge pipelines in Lake Erie at Lake City, Erie County, Pennsylvania. This was our first knowledge of this notice which incorporates a deadline of 19 March 1973.

Since the Pennsylvania Fish Commission has jurisdiction over the fisheries in Lake Erie and the other waters of the Commonwealth, this is certainly within our area of concern, although the Department of Environmental Resources has replied to the effect on fisheries, using as examples the present problems created by the discharge line of the Pennsylvania Electric Company's generating plant on the shores of Erie Bay. There are heavy fish kills of gizzard shad and emerald shiners resulting from changes in temperatures, and the purpose of this letter is to determine whether the Pennsylvania Fish Commission will have a review function in the application for the permit.

At the same time, since we are cooperating with your office in the reactivation of the Elk Creek Harbor Project, our own engineers have put forth an informal suggestion that the possibilities of using somewhat warmer waters to keep the harbor refuge free of ice might be a feasible use of these discharges.

Sincerely,

Ralph W. Abele

Ralph W. Abele
Executive Director

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Checked by
Filed by BRM

RWA/t
cc: Marvin A. Fein, Esq., DER

FEDERAL POWER COMMISSION
WASHINGTON, D.C. 20426

May 9, 1973

IN REPLY REFER TO:

Colonel Robert L. Moore
District Engineer
U. S. Department of the Army
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Dear Colonel Moore:

This is in response to your letter of January 29, 1973, requesting comments on the Draft Environmental Impact Statement prepared by your office, relating to the construction of intake and discharge structures for Pennsylvania Electric Company's proposed Lake City combined cycle electric generating station on Lake Erie near Lake City, Erie County, Pennsylvania.

Pursuant to the National Environmental Policy Act of 1969, and the April 23, 1971, Guidelines of the Council on Environmental Quality, these comments are directed to a review of the need for the proposed facility as concerns the adequacy and reliability of the affected bulk power systems and matters related thereto.

In preparing these comments, the Federal Power Commission's Bureau of Power staff has considered the Corps of Engineers' Draft Environmental Statement; reports made in response to the Commission's Statement of Policy on Reliability and Adequacy of Electric Service (Order No. 383-2); and the Bureau of Power staff's analysis of these documents together with related information from other FPC reports. The staff generally bases its evaluation of the need for a specific bulk power facility upon the load-supply situation of the period immediately following the expected availability of the facility, as well as on long-term power supply requirements.

Utility Background

Pennsylvania Electric Company (PENELEC) is one of four operating subsidiaries of the General Public Utilities System (GPU) which renders electric service in New Jersey and Pennsylvania. Planning and operation of the GPU bulk power supply is fully coordinated. Therefore, for the

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Colonel Robert L. Moore

purpose of this review, GPU is considered to be a single system and the need for Lake City is evaluated in that light. GPU is a member of the Pennsylvania-New Jersey-Maryland Interconnection (PJM), a large highly coordinated power pool. Under the terms of the PJM Interconnection agreement, the member utilities have certain obligations with respect to providing and maintaining adequate reserves in excess of actual load requirements. A reserve objective of 20 percent of peak load is employed by GPU for system planning purposes in satisfying PJM's reliability criteria.

The location of the proposed Lake City combined cycle unit of 250 MW, nominal rating, is about 12 miles southwest of Erie, Pennsylvania, in PENELEC's Northwestern Division. Existing nameplate capacity in the Division consists of the 119-MW Front Street steam-electric plant in Erie, installed between 1917 and 1952, and the 58-MW Wayne combustion turbine station, placed in service in 1972. With Division loads currently in the order of 400 megawatts, it has been necessary to rely on imports to satisfy customer power requirements. PENELEC and GPU, as a whole, are winter peaking while PJM is summer peaking.

Need for the Lake City Facilities

The impact of the Lake City plant on the PJM load-supply situation is minor, in view of the unit's size (250 MW nominal) relative to the expected pool demand of some 38,000 MW in summer 1976. Its effect on the GPU system however, is significant, as shown below. The unit is now scheduled for operation in October 1975. Ambient temperature effects result in the Lake City unit being rated at 267 MW for winter operation and 221 MW for summer operation. Ambient temperature also has an effect on other generating units of the GPU system; these effects are shown below.

GENERATING CAPABILITY PROJECTIONS

	Winter Rating	Summer Rating
Existing Capability, February 20, 1973	6,085 MW	5,674 MW
Net of scheduled additions and retirements prior to winter 1975-1976	1,397 MW	-
Net of scheduled additions and retirements prior to summer 1976	-	2,135 MW

LOAD-SUPPLY PROJECTION, GPU SYSTEM

	Winter 1975-76	Summer 1976
Total Capability, MW	7,482	7,809
Estimated Peak Demand, MW	6,150	6,480
Reserve Margin, MW	1,332	1,329
Reserve Margin, Percent of Peak Demand	21.7	20.5
Reserve without Lake City, MW	1,065	1,108
Reserve without Lake City, Percent	17.3	17.1

For the peak periods shown, GPU margins with the Lake City unit satisfy the 20 percent reserve criterion. Without Lake City, however, reserves fall below the desired level. It should be noted that in considering the impact of the proposed plant on PJM's and GPU's power supply, the on-time completion of all scheduled additions was assumed. In the light of recent and current experience with respect to slippage of new capacity, delays are likely to occur, resulting in reserve margins less than those indicated.

Transmission

Transmission in PENELEC's Northwestern Division is at 345, 230, and 115 kilovolts. Distribution in the area is mainly supplied from the 115-kilovolt network. There are interconnections with Ohio at 345 kilovolts and New York at 230 kilovolts. The proposed Lake City unit would be tapped into the existing 115-kV network requiring no new facilities.

Alternatives to the Proposed Facilities

As alternatives to the Lake City Plant, consideration was given by PENELEC to the use of other types of generation, location of the unit in other parts of the GPU system, and the purchase of firm power from other utilities. None of these proved to be feasible in the time period studied. Lake City will have added value because it provides local protection in a capacity-deficient load area that is now dependent on power imports to satisfy its requirements. This additional generating capacity would have the beneficial effect of relieving the transmission burden in the Northwestern Division.

Colonel Robert L. Moore

Conclusion

The staff of the Bureau of Power concludes that the electric power output represented by the Lake City plant is needed to meet GPU's projected system loads and reserve margin requirements.

Very truly yours,

T. A. Phillips
Chief, Bureau of Power

APPENDIX A

EVALUATION OF STACK EMISSIONS AND DIFFUSION ANALYSIS

APPENDIX A

A1 EVALUATION OF STACK EMISSIONS AND DIFFUSION ANALYSIS

A1.1 Introduction

The dispersion of stack emissions is a function of meteorological phenomena. Variations in air turbulence, wind speed, ambient temperature, and wind direction influence ground level concentration of contaminants. Responding to the review of the agency and recognizing the importance of meteorology, Dr. J. M. Austin (Professor of Meteorology, Massachusetts Institute of Technology) was retained as a special consultant to direct the course of this investigation.

A1.2 General

A series of calculations were made using the basic information of Table A-1 and well recognized dispersion modeling techniques to predict ground level concentrations of contaminants that could occur on the basis of a 3 hour, 24 hour, and annual maximum average for normal meteorological conditions. A prediction was made also for the case of "plume trapping" under inversion conditions and the condition of "inversion breakup" was also considered.

A1.3 Methodology

The three components of an estimate of ground level concentration are: (a) the plume rise from the stack, (b) the relevent meteorological conditions, and (c) the dispersion for these conditions. Computations of maxima have been based on formulae in standard reference sources (Reference A-1).

A1.3.1 Plume Rise

The plume rise has been calculated from the Briggs equations (Reference A-2). For neutral and slightly unstable air (stability class B, C, and D) Equation A-1 (Table A-2 and A-3) was used, and the distance from the source to the point of maximum plume rise was determined from Equation A-2 (Reference A-3). For the stable class E, Equations A-4 and A-5 (Table A-3) were used correspondingly.

A1.3.2 Stack Arrangement

The arrangement of stacks in the plant is uncommon. Due to the configuration of the steam generators, gas is emitted from the plant through four stacks, each of dimension 82 in. x 144 in. The stacks are arranged in pairs with 14 ft between center lines of each one of a pair, and 75 ft between center lines of pairs. Bosanquet et al., (Reference A-3) stated that plumes from multiple

stacks will rise higher than a plume from only one of them. Buoyancy flux in the plume rise equation was taken as that corresponding to one stack only. The prediction of plume rise should be conservative on that account.

A1.3.3 Coning Dispersion Model

Meteorological conditions at the plant location can vary over a wide range; and, accordingly, ground level concentrations can also range over orders of magnitude. It has been well established by formulae and by observations that the highest ground level concentrations with hot effluents from stacks accompany neutral to unstable atmospheric conditions in the ground layer. Hence, we shall here consider such a spectrum of stability conditions. A stack plume usually spreads downwind with its outer edges approximating a cone. Such dispersion is referred to as the "coning" case. The estimates of ground level concentration under this condition are based on formulae and parametric values given in the EPA Workbook. Ground level center line concentrations were calculated using Equation A-3. In the use of Workbook Values for parameters σ_y and σ_z in Equation A-3, ground level concentrations averaged over a 10 minute period are obtained. A 3 hour maximum can be estimated from a 10 minute maximum through the application of the one fifth power law which gives a 3 hour maximum as 56 percent of a 10 minute maximum.

A1.3.4 Inversion Condition

On occasions, an elevated temperature inversion restricts the upward dispersion of the plume with the net effect that more of the effluent is mixed downwards to the ground thereby enhancing the ground level concentrations. This meteorological condition is referred to as "inversion lid" or "trapping". Under trapping conditions the ground level concentrations are dependent on the elevation of the "lid". If the "lid" is too low, the plume penetrates the inversion and is thus shielded from the ground so ground level concentrations are close to zero; if the lid is high, the dispersion approximates the normal "coning" case. For each wind speed and corresponding plume rise, the optimum lid height for the maximum ground level concentration is to place the lid at the lowest elevation for the entire plume to remain in the atmospheric layer beneath the lid. For the calculation of a 1 hour maximum value under such conditions, B stability class and 5 meters/sec wind velocity was used. Equation A-1 was used to calculate plume rise and Equations A-6 and A-7 (Equations 3.3 and 5.9, respectively from the Workbook) were used for calculation of concentrations. L in Equation A-7 is the lid elevation and is taken as the value of H with Δh being determined from Equation A-1 for the wind speed of 5 meters/sec. The calculations were made for $y = 0$ i.e., centerline values.

A 3 hour maximum value is obtained from the 1 hour value by application of the one fifth power law giving a value of 109 micrograms per cubic meter $\left[136 \times (\frac{1}{3})^{1/5}\right]$.

The 24 hour maximum ground level concentration is computed by the method suggested in Appendix A of the Federal Register of November 25, 1971. The 1 hour trapping maximum is multiplied by 0.25 to give a 24 hour maximum.

An analysis of the "inversion breakup" condition, during the morning, is not included insofar as it is a transitory short-term (less than 1 hour) phenomenon. The longer-term (3 hour) restricted plume dispersion is the "inversion lid" or "trapping" case, where the upward dispersion is inhibited by a persistent lid and the layer beneath the inversion is unstable.

A1.3.5 Annual Average Concentration

A stability wind rose for Cleveland/Hopkins Airport (based on 5 years of data) was used for this calculation. Three wind directions (South, SSW, and Southwest) were seen to be predominant. Plume rise was calculated for stability Class B, C, and D from Equation A-1 and for stability Class E from Equation A-4. Equation A-8 taken from the Workbook was used for ground level concentration calculations based on 22-1/2^{o} sector. Calculations were made for each stability class and wind velocity was reported. The resulting concentrations were summated and averaged to give the annual value. The calculations were made for each of the three wind directions.

A1.4 Results

Exhibits A-1 through A-4 show plots of maximum 3 hour average center line ground level concentration of SO_2 against downwind distances for each of the stability Classes B, C, D, and E. Exhibit A-5 shows maximum 1 hour value under trapping conditions. The maximum 24-hour concentration, calculated from the one-hour trapping condition is found to be 34 micrograms per cubic meter. Exhibit A-6 shows a plot of annual average SO_2 concentration for the three wind directions having the predominant frequency.

A1.5 Downwash

The reviewer raised the consideration of aerodynamic downwash. With this concern in mind, a recognized authority in this field, Dr. J. Halitsky of the University of Massachusetts was retained by PENELEC. His Special Technical Report is submitted as an appendix of this final document.

A1.6 Other Contaminants

The meteorology and the dispersion modeling techniques are identical for all contaminants so the ratios of contaminant concentrations at ground level are provided by the ratios of the quantities emitted from the source. In order to avoid undue repetition reference is made to SO_2 only in the description and graphical presentation of the results. The concentration of other contaminants may be obtained as follows:

for particulates multiply SO_2 values by 0.032

for NO_x multiply SO_2 values by 1.24

A1.7 Summary

In order to assess the environmental impact of the proposed plant, a prediction of the dispersion of ground level concentration of contaminants was made under meteorological conditions that could be expected to occur at least once in a year. The results of this study (Table A-4) show clearly that predicted values are much below standards. The highest value calculated in terms of standards was the 24 hour maximum SO_2 concentration and it was only 13 percent of the Federal Secondary Standard. An attempt was made to determine "Background Values" to which the plant contribution would be added. Information was received from the Meadville Regional Office of the D.E.R. Two 24 hour data listings prepared by the National Air Surveillance Network of EPA were supplied. The first list was a set of 12 recordings made in the period from July to December 1970, with a minimum of one and a maximum of three observations per month. A zero value was reported for five of the twelve observations. The maximum value reported was 209 micrograms per cubic meter and the geometric mean was 23 micrograms per cubic meter. The second list obtained was a series of 24 observations made twice monthly throughout 1972. The highest value recorded was 106 micrograms per cubic meter and the geometric mean was 20 micrograms per cubic meter. The data were obtained at the monitoring site at 606 West Second Street in the City of Erie. The Lake City Site is in open country and should have lower background contaminant levels than those from an urban site. It is apparent that the plant contribution, added to "background", gives maximum ground-level concentrations much below standards.

The concentration values in Table A-4 for 3 hour and 24 hour averages are estimates of the maxima for these time periods. They are much higher than the "normal" values expected in the vicinity, from the power plant source. The maximum annual average of 1.25 micrograms per cubic meter is one measure of the "average" concentration close to the proposed plant, arising from the power plant alone. This maximum annual average is probably an over-estimate since it is calculated from σ_z's which are calibrated for maximum (and not average) concentrations. Another measure of the

"normal" ground level concentrations can be obtained through the use of ratios determined from a paper by Martin and Barber (Reference A-5). They show that the median downwind 1 hour concentration, at the location of the maximum concentration is approximately 0.07 times the maximum concentration. Also, that the median 24 hour average is approximately 0.04 times the maximum 24 hour average. Applying these ratios we obtain 8 micrograms per cubic meter as a "normal" 3 hour concentration about 2 km from the plant, in a 22-1/2^{o} sector downwind of the plant. Similarly, the median 24 hour average at a downwind location is 1.4 micrograms per cubic meter. This 24 hour median estimate is an order of magnitude less than the indicated median background value at 606 West Second Street in the City of Erie.

The emission rate of unburnt CO is not well established yet for a plant of the subject type. Definite values will not be available until the prototype becomes operational before the end of 1973. The manufacturer is confident, however, that should values in excess of standards be measured test evolutionary burner development will be incorporated into the proposed plant to bring CO into conformance with standards.

The reviewer has also raised questions in the area of NO_x emissions and contamination.

On June 20, 1972 PENELEC counsel sought an interpretation from the Director, Division of Stationary Source Enforcement of the EPA on the applicability of the Standards of Performance of New Stationary Sources (40 CFR Part 60) to a combined combustion turbine and steam generating plant. The Director in his reply of July 3, 1972 indicated that "both the heat input and emission products of the combustion turbine will be excluded in determining compliance of the steam generating plant with the Standards of Performance for New Stationary Source (40 CFR Part 60)." The reviewer now invites our attention to the fact that Standards for Combustion Turbines are due to be proposed by EPA in the near future; and he continues to say, "These Standards will probably limit emissions approximately to the levels permitted for new boilers; and this source would exceed such a NO_x Standard several fold." The manufacturer of the combined cycle plant has on going research programs in the area of reducing NO_x emissions, and he is prepared to furnish this plant with equipment which can effectively lower NO_x below standards. An explanation of the lower production of NO_x in the auxiliary duct burners than in the combustion turbines (0.23 lbs/10^6 Btu vs 0.72 lbs/10^6 Btu) is as follows. Oxides of nitrogen formations are fixed primarily by the rate of formation and residence time in the hot reaction zones of the combustion equipment. These characteristics are very different for combustion turbines and duct burners. The former has characteristically produced more NO_x than the latter. Research is active in this area and abatement techniques are available.

A1.8 Emissions

Tabulations of emissions are presented in Tables A-5, A-6, and A-7.

TABLE A-1

BASIC INFORMATION

Stack Height	85 ft
Tallest Adjoining Building	65 ft
Plant Elevation	700 ft
Fuel Used (See Fig. 8.1-2)	No. 2 standard
Maximum Sulphur Content by Weight	0.5%
Average Sulphur Content by Weight	0.35%
Maximum Gas Flow Total	1400 lbs/sec
Maximum Gas Flow/Stack	350 lbs/sec
Stack Flue Gas Temperature	340
Stack Dimensions (Each of 4)	82 in. x 144 in.
Ambient Air Temperature (for diffusion calculations)	70 F

TABLE A-2

NOTATIONS

Δh	Plume rise above top of stack
F	Buoyancy flux parameter
u	Average wind speed at stack level
x	Horizontal distance downwind of stack
Q_H	Heat emission due to efflux of stack gases
X	Concentration of gas or aerosols
Q	Emission rate of pollutants
σ_y, σ_z	Standard deviation of plume concentration distribution in the horizontal and vertical respectively
H	Effective emission height (sum of physical stack height and plume rise Δh)
s	Restoring acceleration per unit vertical displacement for adiabatic motion in atmosphere
g	Gravitational acceleration
$\frac{\delta_\theta}{\delta_z}$	Vertical potential temperature gradient of atmosphere
L	Height of stable layer
x,y,z	Co-ordinate dimensions from source, downwind, perpendicular thereto, and vertical
x_L	Downwind distance corresponding to σ_z when σ_z is set equal to 0.47L

TABLE A-3

FORMULAE

$$\Delta h = 1.6\ F^{\frac{1}{3}}\ u^{-1}\ x^{\frac{2}{3}} \qquad \text{A-1}$$

where $F = 3.7 \times 10^{-5}\ Q_H$ in this equation

$$x = 119\ F^{\frac{2}{5}} \qquad \text{A-2}$$

$$X = \frac{Q}{\pi\sigma_y\sigma_z u}\ \exp\left[-\frac{1}{2}\ \left(\frac{H}{\sigma_z}\right)^2\right] \qquad \text{A-3}$$

$$\Delta h = 2.9\ \frac{F}{us}\ \frac{1}{3} \qquad \text{A-4}$$

where $F = 3.7 \times 10^{-5}\ Q_H$

and $S = \frac{g}{T} \cdot \frac{\delta_\theta}{\delta_z}$

$$x = 2.4\ \frac{u}{s^{1/2}} \qquad \text{A-5}$$

where $s = \frac{g}{T} \cdot \frac{\delta_\theta}{\delta_z}$

$$X = \frac{Q}{\pi\sigma_y\sigma_z u}\ \exp\left[-\frac{1}{2}\ \left(\frac{H}{\sigma_z}\right)^2\right] \qquad \text{A-6}$$

for all values of x from source to x_L

$$X = \frac{Q}{\sqrt{2\pi}\sigma_y L u}\ \exp\left[-\frac{1}{2}\ \left(\frac{y}{\sigma_y}\right)^2\right] \qquad \text{A-7}$$

for all values of x greater than $2x_L$

$$X = \frac{2.03\ Q}{\sigma_z\ ux}\ \exp\left[-\frac{1}{2}\ \left(\frac{H}{\sigma_z}\right)^2\right] \qquad \text{A-8}$$

TABLE A-4

COMPARISON OF AIR QUALITY STANDARDS AND PREDICTED GROUND LEVEL CONCENTRATIONS

	Predicted Values	Federal Standard Primary	Federal Standard Secondary
Sulphur Dioxide			
Max. annual average	1.25	80	60
Max. 24 hour	34	365	260
Max. 3 hour	109		1300
Particulate Matter			
Max. annual average	0.04	75	60
Max. 24 hour	1.09	260	150
Nitrogen Oxide			
Max. annual average	1.55	100	100

All values expressed in micrograms per cubic meter.

TABLE A-5

ESTIMATED NITROGEN OXIDES

Source of Emission	Heat Input MBTU/hr[1]	No. of Stacks in Operation	Total lbs/hr.	NO_x Release Rate lbs/hr/stack	NO_x Release Rate lbs/MBTU	Pennsylvania Proposed Allowable Emission	Federal EPA Allowable Emission lbs/MBTU (Max. 2 hr Avg.)
Combined Cycle (Combustion Turbines + Supplementary Fired Heat Recovery Steam Generators)							
@ Peak	2248.4	4	1440	360	.64	No state criteria established at the present time.	No criteria for combustion turbines yet established
Combustion Turbines							
@ Peak	1898.3	4	1360	340	.72	No state criteria established at the present time.	No criteria for combustion turbines yet established
Supplementary Fired Heat Recovery Steam Generators							
@ Peak	350.1	4	80	20	.23	No state criteria established at the present time.	0.30

TABLE A-6

ESTIMATED SULFUR DIOXIDE

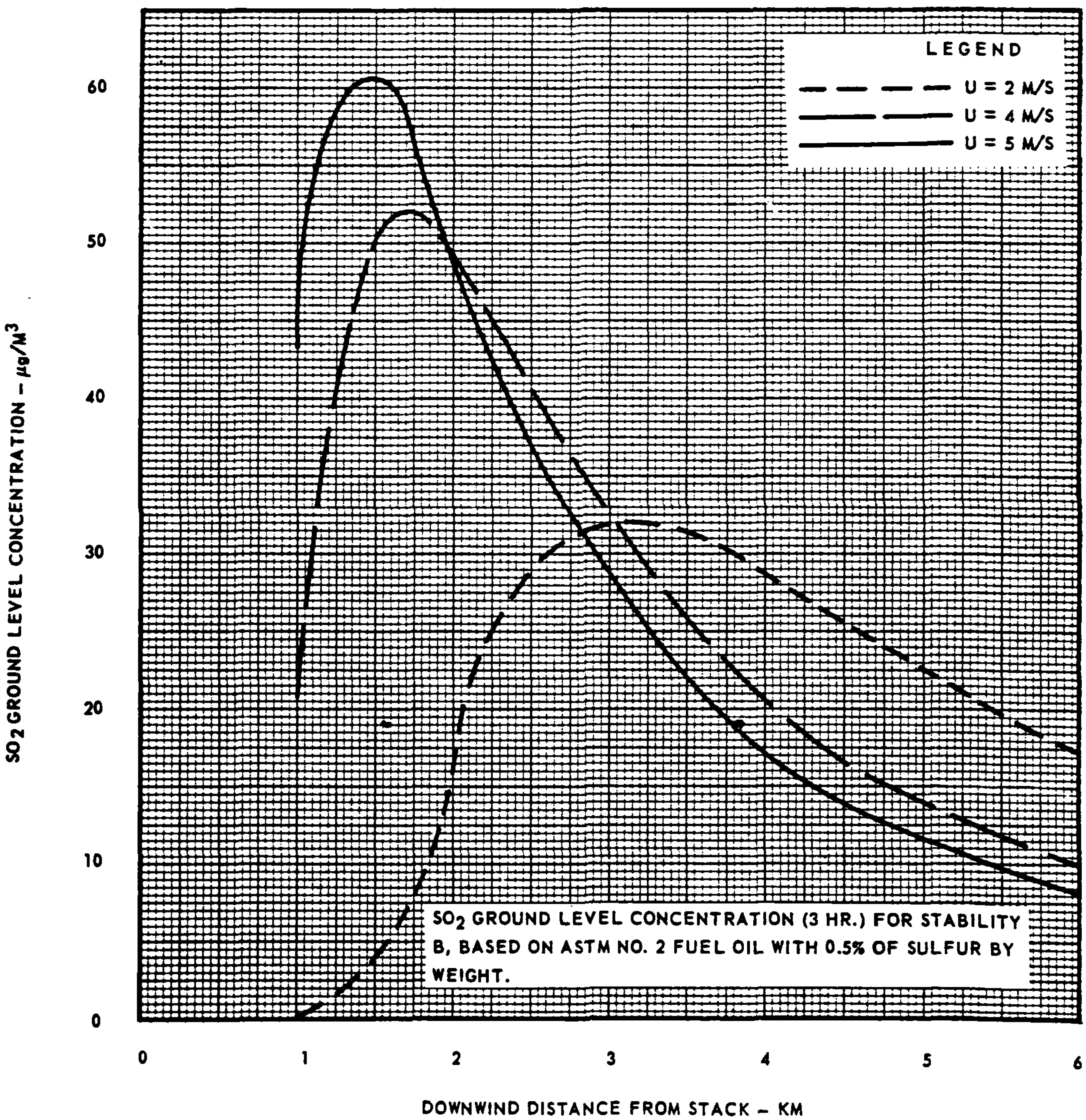
Source of Emission	Heat Input MBTU/hr[1]	No. of Stacks in Operation	Total lbs/hr.	SO_2 Release Rate lbs/hr/stack	SO_2 Release Rate lbs/MBTU	Pennsylvania Proposed Allowable Emission	Federal EPA Allowable Emission lbs/MBTU (Max. 2 hr Avg.)
Combined Cycle (Combustion Turbines + Supplementary Fired Heat Recovery Steam Generators)							
@ Peak	2248.4	4	1166	291	0.52	4.0 lbs per million BTU Heat Input	No criteria for combustion turbines yet established
Combustion Turbines							
@ Peak	1898.3	4	984	246	0.52	4.0 lbs per million BTU Heat Input	No criteria for combustion turbines yet established
Supplementary Fired Heat Recovery Steam Generators							
@ Peak	350.1	4	182	45.5	0.52	4.0 lbs per million BTU Heat Input	0.80

TABLE A-7

ESTIMATED PARTICULATES

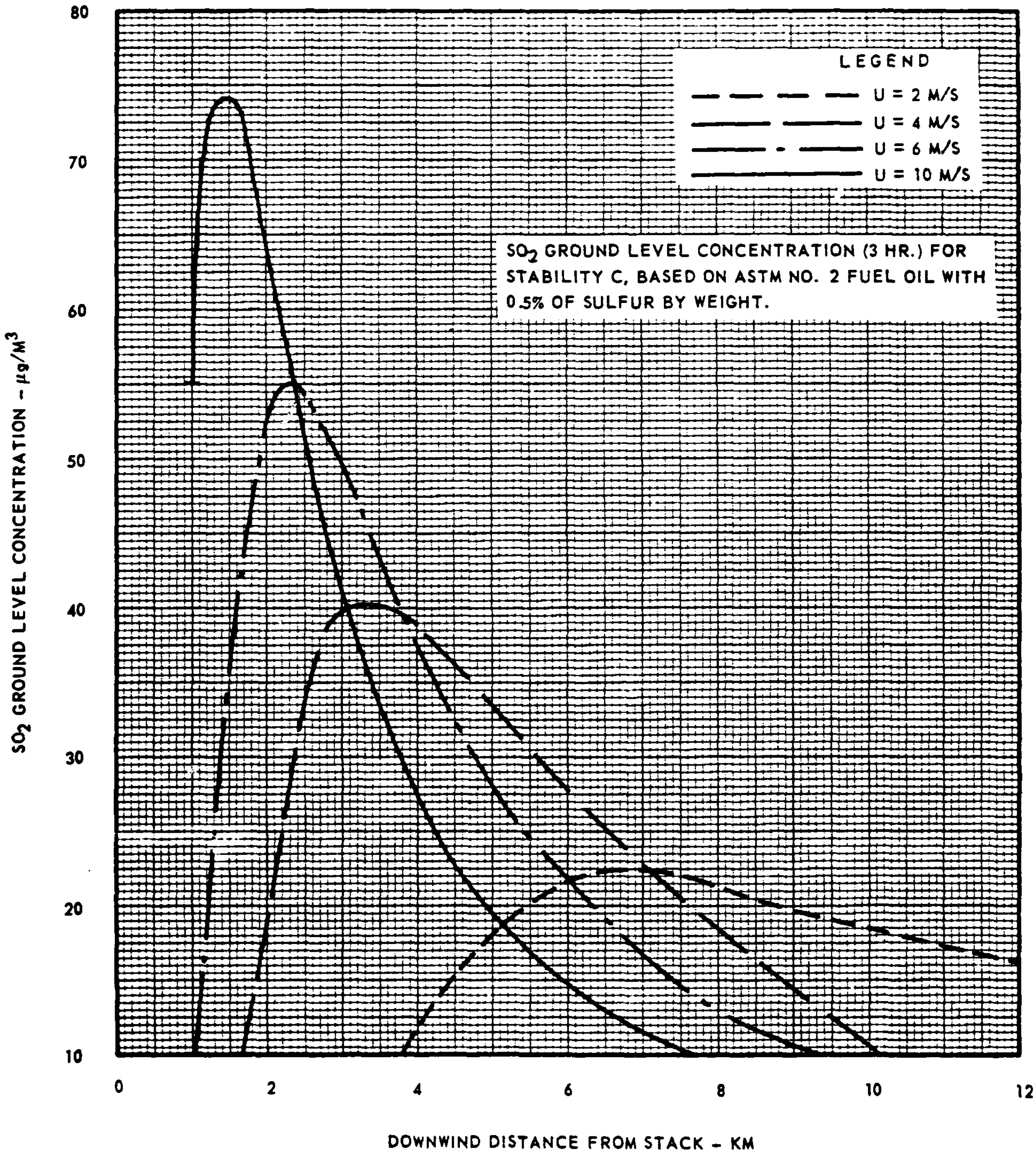
Source of Emission	Heat Input MBTU/hr[1]	No. of Stacks in Operation	Total lbs/hr.	Particulates Release Rate		Pennsylvania Proposed Allowable Emission	Federal EPA Allowable Emission lbs/MBTU (Max. 2 hr Avg.)
				lbs/hr/stack	lbs/MBTU		
Combined Cycle (Combustion Turbines + Supplementary Fired Heat Recovery Steam Generators)							
@ Peak	2248.4	4	37	9.0	.016	.1 lbs/MBTU	No criteria for combustion turbines yet established
Combustion Turbines							
@ Peak	1898.3	4	32	8.0	.017	No established limit for combustion turbines	No criteria for combustion turbines yet established
Supplementary Fired Heat Recovery Steam Generators							
@ Peak	350.1	4	5	1.23	.014	.1 lbs/MBTU	0.1

PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



STABILITY B
EXHIBIT A-1

PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



STABILITY C
EXHIBIT A-2

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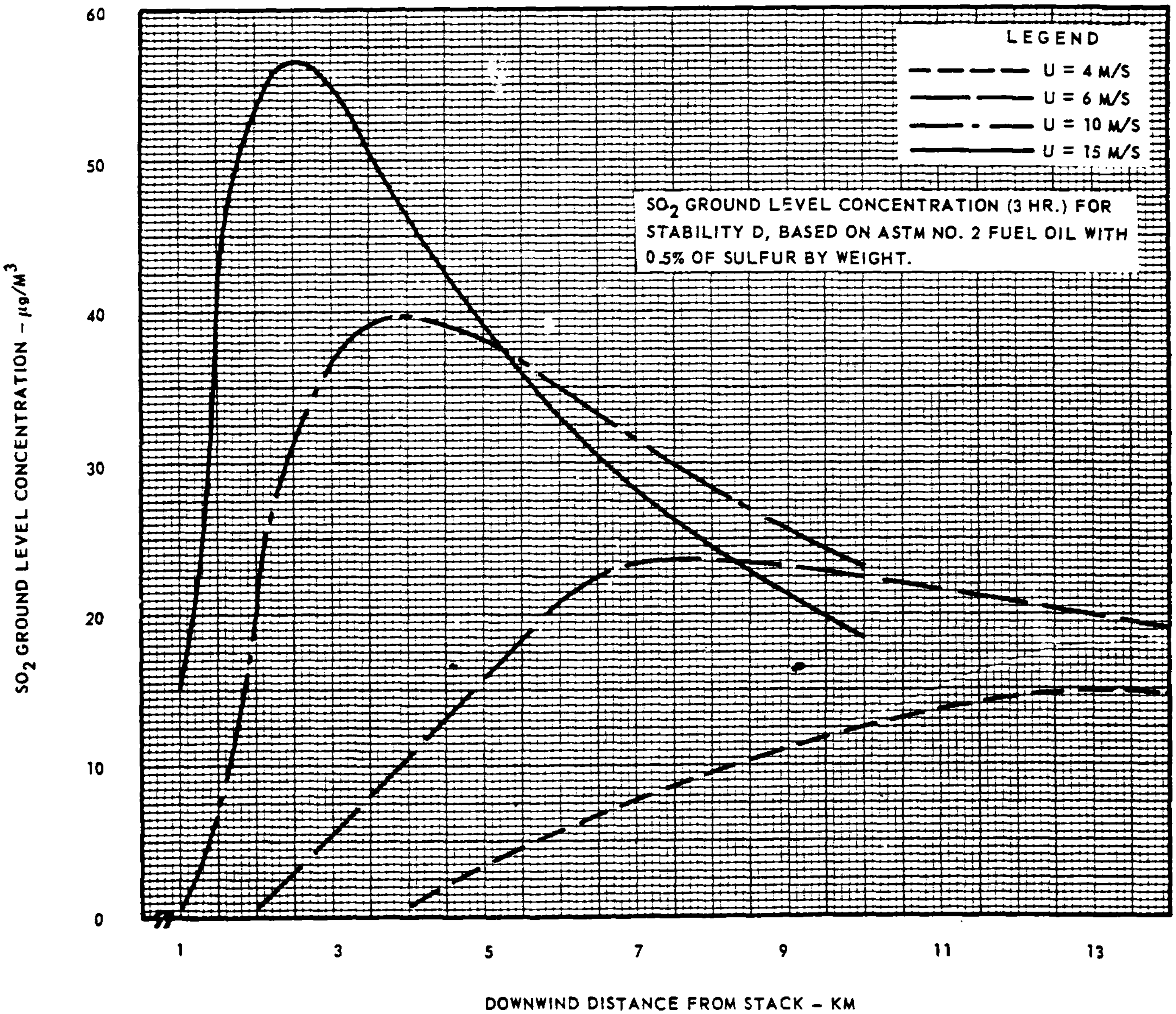
LAKE CITY PLANT



STABILITY D
EXHIBIT A-3

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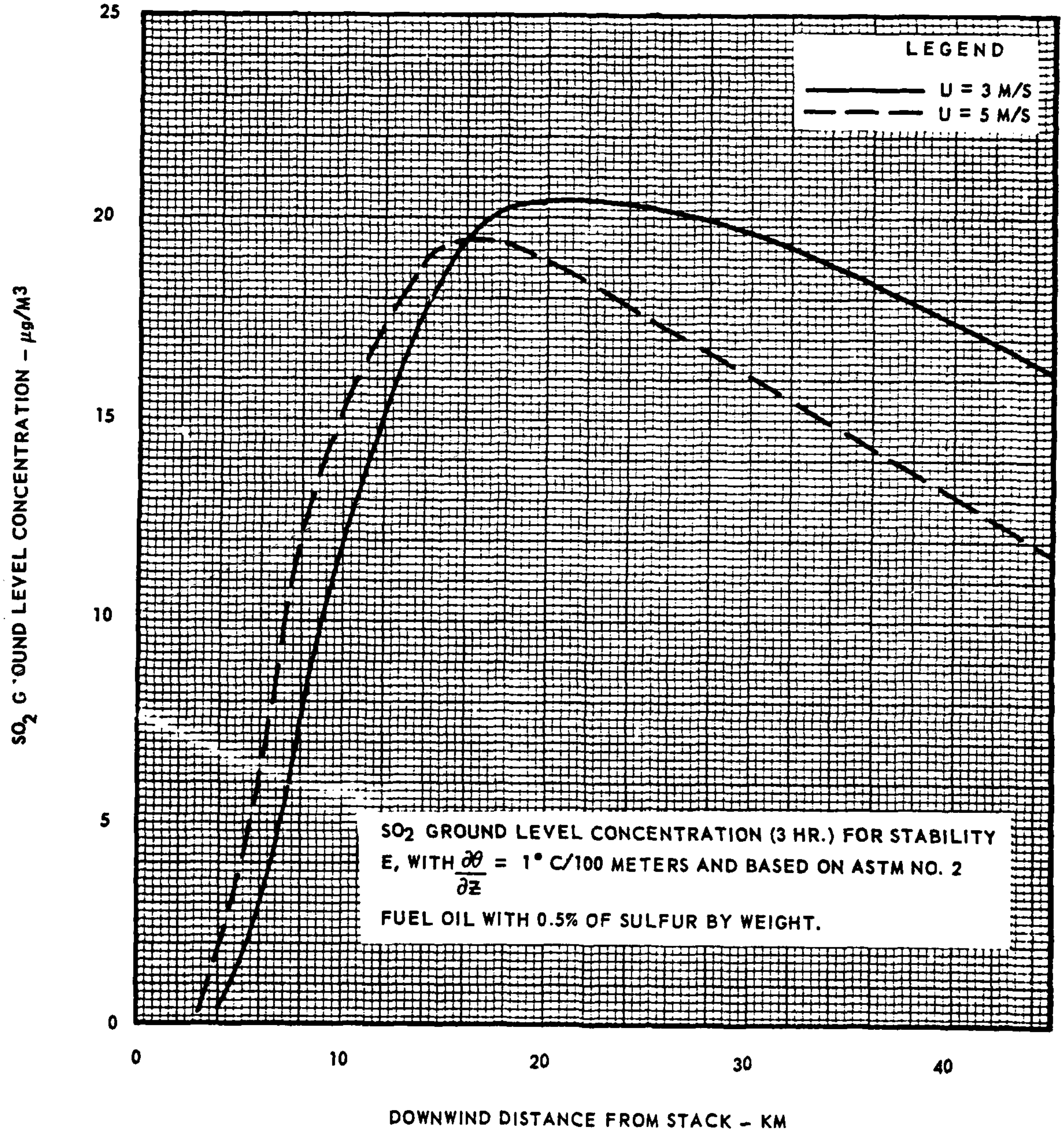
LAKE CITY PLANT



STABILITY E
EXHIBIT A-4

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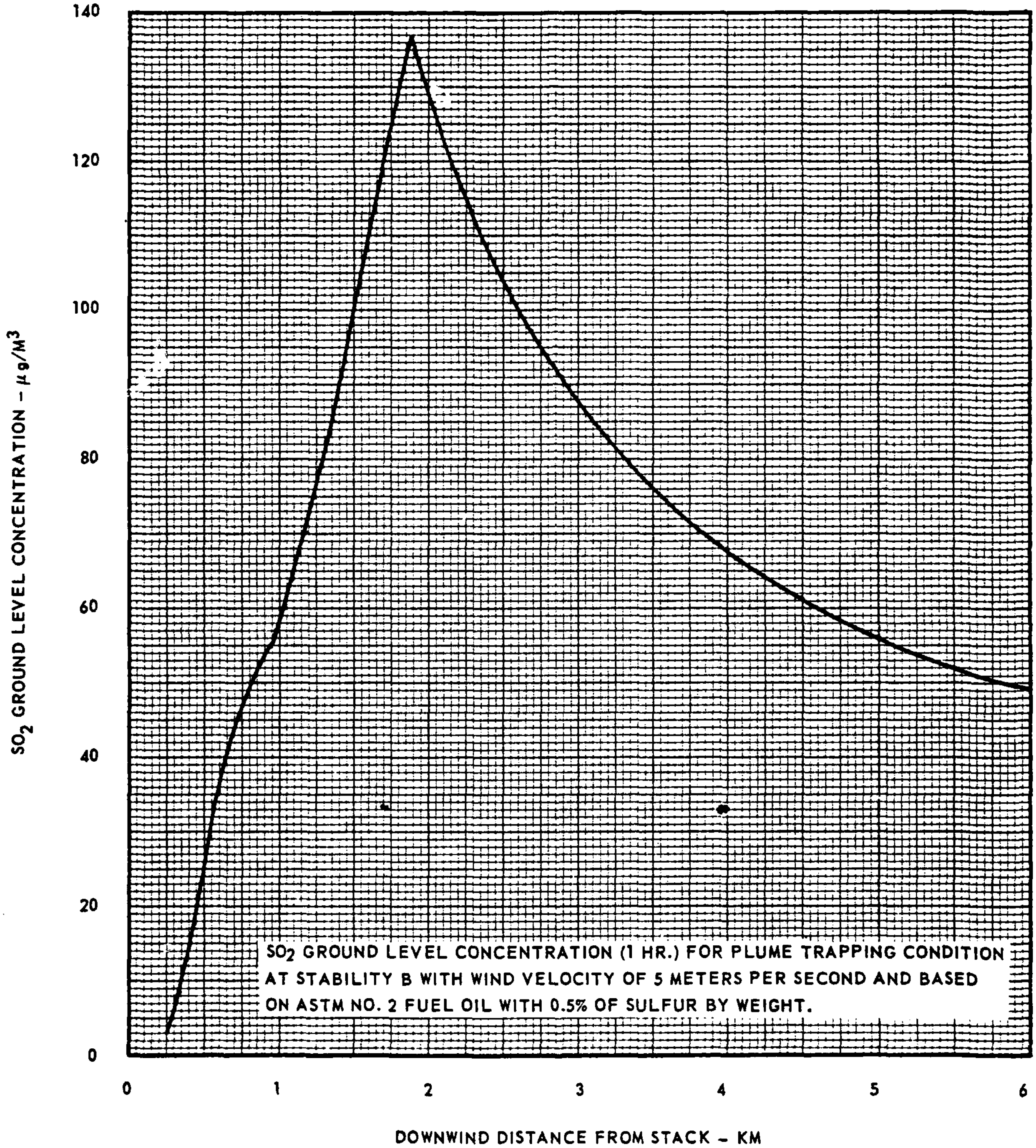
LAKE CITY PLANT



STABILITY B
EXHIBIT A-5

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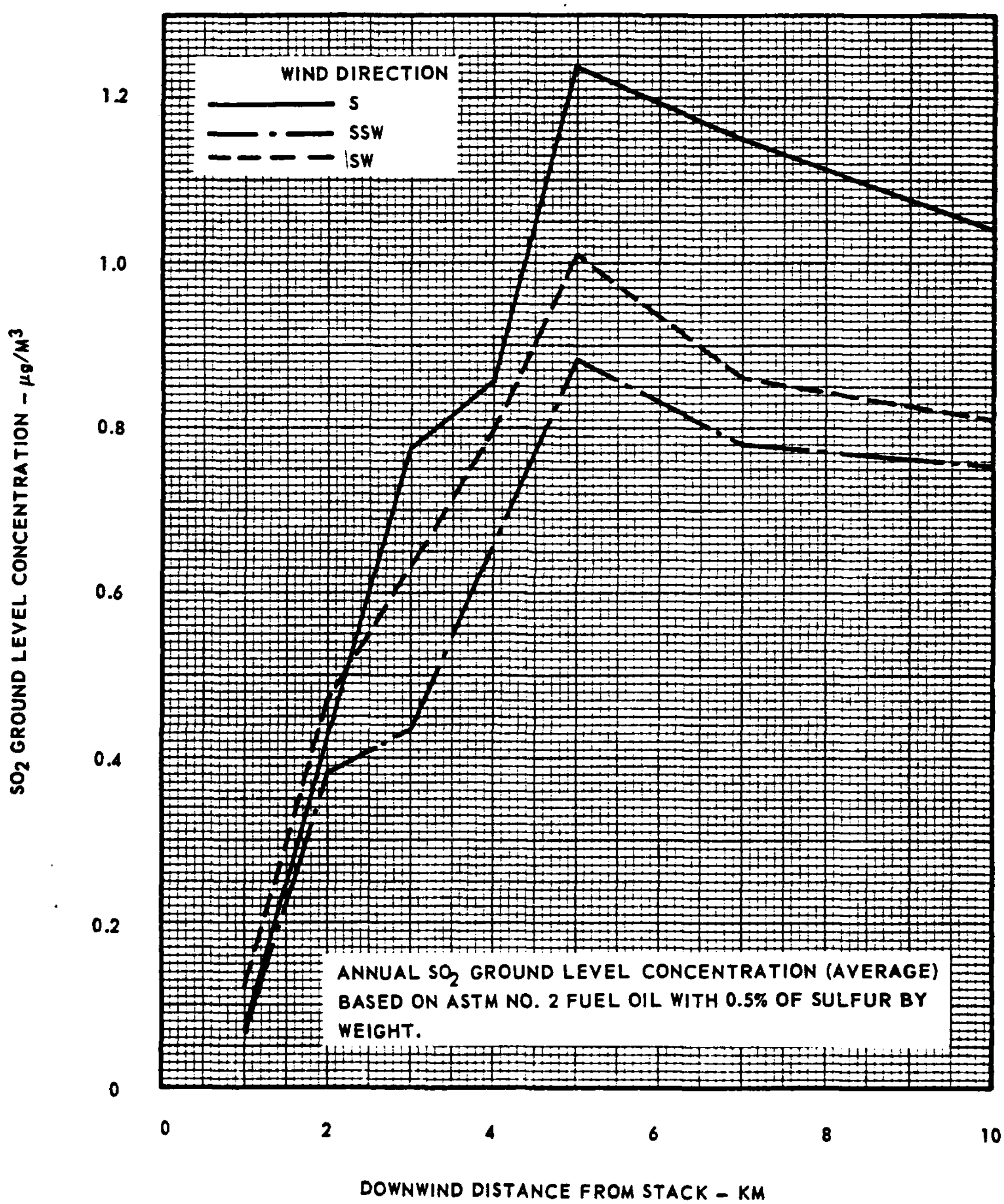
LAKE CITY PLANT



ANNUAL SO_2
GROUND LEVEL CONCENTRATION
EXHIBIT A–6

REFERENCES FOR APPENDIX A

A-1 "Workbook of Atmospheric Dispersion Estimates", (Revised 1970 edition) Environmental Health Series. Published by U. S. Environmental Protection Agency.

A-2 G. A. Briggs, "Plume Rise", AEC Critical Review Series, USAEC Report TID-25075, November 1969.

A-3 G. A. Briggs, "Some Recent Analyses of Plume Rise Observations, Proceedings of the Second International Clean Air Congress", Academic Press, New York, 1971.

A-4 C. H. Bosanquet, W. F. Carey, and E. M. Halton, "Proceedings of the Institution of Mechanical Engineers", 1950.

A-5 A. Martin and F. R. Barber, "Investigations of Sulphur Dioxide Pollution Around a Modern Power Station", in the Journal of the Institute of Fuel, July 1966.

APPENDIX B

THERMAL EFFLUENT CONSIDERATIONS

APPENDIX B

B1 THERMAL EFFLUENT CONSIDERATIONS

B1.1 Description of Thermal Effluent Dilution Characteristics

The thermal effluent from the 250 MW combined cycle unit will vary with atmospheric conditions and the degree to which the water in the cooling tower circuit is concentrated. The effluent (blowdown) will vary with concentration as follows:

Plant Requirements	Cooling Tower Concentrations		
	2	3	4
Blowdown (thermal effluent) (gpm)	1400	700	467

Under average operating conditions, three concentrations of water in the cooling tower will prevail, however, to define the range of performance of the proposed submerged discharge structure, the blowdown flows corresponding to two and four concentrations were used.

When the heated blowdown is discharged from a multiple port diffuser into a receiving water of greater density, the blowdown is diluted by turbulent jet mixing. Table B-1 is based on an outlet diffuser depth of 12 feet below minimum lake water level, and on temperature measurements taken during the winter, spring, and summer of 1969 in the neighborhood of Presque Isle, (Reference B-1); However, it should be printed out that the diffuser outlets are placed 14 feet below lake low water level.

From the foregoing table, it can be concluded that during the months in which the lake surface is free of ice, the maximum temperature differences between the diluted plant blowdown and the lake surface temperature will be 2°F. Comparison of the temperatures of the lake survey for Hammermill Paper Mill Corporation, with the lake temperature data published by International Joint Commission (Reference B-2), disclosed that the water temperatures at the Lake City Plant diffuser outlet area should be lower than the cases given in the above tables.

After the waste has been initially diluted, there develops an almost homogeneous mixture in the vicinity of the point of discharge. With the passage of time, this mixture of

blowdown water and lake water, which is called the blowdown diluted effluent field, begins to drift away from the point of discharge with the prevailing lake currents. As the blowdown diluted effluent field drifts, it also begins to spread in the shape of a plume. The center of this effluent field will be located 1350 feet from the lake shoreline.

The diffuser is oriented in a direction N 20°W, perpendicular to the predominant lake currents (Reference B-1 and B-2) to achieve maximum dilution. A port diameter of 2-1/2 inches will be used for the total length of the diffuser and the eight ports will be spaced on 10 feet centers. To minimize interference between adjacent buoyant jet plumes, the ports will discharge horizontally and alternatively to opposite sides of the diffuser.

The Outfall-Diffuser System Feasibility Study for the Hammermill Paper Company (Reference 3.2-8) indicates that in the area of the lake located East of Presque Isle Peninsula, the lake water currents are larger than 8.65 feet per minute 80 percent of the time, since this velocity is the maximum water current at which a stratification layer with a 2°F differential can be maintained. Therefore, stratification of the diluted effluent plume will be possible 20 percent of the time (Reference 3.2-7 and 3.2-10); however, the lake water currents at the unprotected shoreline at the plant site will be larger than these encountered in Erie, Pennsylvania in the protected area east of Presque Isle Peninsula where the Hammermill Paper Company has its outfall diffuser, and therefore it can be concluded that epilimnetic stratification will only be possible a small part of the time.

From the tabulation shown in Table B-1, it can be concluded that the water temperature at the surface of the lake under normal conditions (lake surface not frozen) will not rise more than 2°F over the temperature that existed before the addition of the heated effluent.

This difference can be seen from Table B-1 by examining the column entitled "Diluted Effluent Temperature" as opposed to the adjacent column entitled "Lake Surface Temperature".

B1.1.1 Characteristics of the Shore

The shore line consists of easily eroded bluffs some 80 to 100 feet high fronted by narrow shingle beaches which are exposed or inundated depending on the variations in lake levels. The bluffs are the major source of beach material in the area. Very little of the material from the west or east comes into the area and very little is supplied by tributary streams because of the harbor structures at Conneaut Harbor to the west and Presque Isle to the east; this assumption is further corroborated by the attached diver's report (Section 2).

Analyses of the bluff material have been made (Reference B-6) and found that only about 30 percent is suitable for beach building. Littoral drift is predominately from the west due to the greater pitch and movement of winds from the westerly quadrant. From sounding and the report of the diver (Reference B-7) the offshore bottom is gradual sloping shale with very little sand cover.

B1.1.2 Ice

In early December of average winters ice starts to form in the shallow waters along the lake shore. During severe winters the entire lake may freeze over to a depth of 3 feet. During this time the shore is protected from wave attack. By early March the ice begins to break up and forms floating ice fields which are moved by wind and waves. The floating ice cakes can then buffer shore structures (Reference B-6).

B1.1.3 Lake Levels

The erosion rate is greatly effected by the lake levels since wave attack during periods of high lake levels is directly on the toe of the bluffs. During periods of low lake levels the waves are broken by the protective beach. When the water is deeper the waves can move closer to the shore before breaking.

Minimum lake levels occur during the winter months when precipatation is in the form of ice and snow. High levels occur during the summer months when the full effect of run-off is felt (Reference B-6).

Another important cause in lake level fluctuation is due to wind set up and seiches. These causes are more important on Lake Erie than on the other lakes due to its relatively shallow depth as compared to the other Lakes. Westerly and onshore winds tend to raise water levels in the Lake City area while easterly and offshore winds tend to lower water levels.

B1.1.4 Seiches

Seiches caused by wind are the most common on Lake Erie. As the wind stress which causes the wind setup begins to lessen, the water can no longer remain an adverse gradient and an inertial surge of water or a seiche takes place. These seiches move mainly from east to west due to the orientation of the lake and the predominate direction of storm movement (Reference B-9).

Seiche action is greater at the west and east ends of the lake; and it is expected that during seiche periods the stratification of the diluted effluent at the plant site will be non-existent.

B1.2 Proposed Protective Measures

When the heated blowdown is discharged from a multiple port diffuser into a receiving water of greater density, the Blowdown is diluted by turbulent jet mixing. The velocity gradient between the edge of the plume and the surrounding water causes a turbulence and resultant mixing action as the plume rises toward the surface due to its bouyancy.

Theoretical analysis (Reference B-3) shows that the dilution factor is related to the depth from the water surface to the center of the discharge jet, Y, the diameter of the discharge orifice, B, the blowdown discharge per jet, Q, and the densimetric Froude number, F, for a liquid - liquid system defined as:

$$F = \frac{V^2}{\frac{\Delta S}{S} \cdot g.B}$$

Where:

V = jet velocity

S = specific gravity of blowdown

ΔS = difference in specific gravity between the blowdown and surrounding lake water

g = acceleration due to gravity

B = discharge jet diameter

The interrelationship of these variables can be seen in Reference B-4, where the dimensionless ratio Y/B is plotted versus the Froude number and various dilution factors, D, contours are obtained.

To allow installation of additional multiport diffuser pipe dictated by future operating conditions or new regulatory requirements due to environmental changes, the end of the submerged diffuser pipe will be provided with:

a. A removable plug furnished with lifting eyes.

b. An extended trench beyond the end of the outfall terminus for a minimum length of 20 feet. The trench will be back-filled with excavated material.

A proposed sequence of construction to reduce the inconvenience caused by removal of excavated materials is to open a trench section with explosives, placing bedding material in the bottom, install a pre-assembled pipe section, backfill around the offshore pipe with material extracted from the next section of trench, and remove excess material.

Riprap will be placed on top of the pipe to protect the pipe against wave forces and erosion effects in the shallow waters. In the diffuser area the bottom of the pipe installation will be protected and stabilized with tremie concrete.

TABLE B-1

DILUTION OF HEATED EFFLUENT

Season	Cooling Tower Blowdown Flow GPM	Lake Bottom Temperature °F	Plant Effluent Temperature °F	Dilution**	Diluted Effluent Temperature °F	Lake Surface Temperature °F
Winter*	1400	33.0	53.0	14	34.4	32.0
Winter*	467	33.0	53.0	11	34.5	32.0
Spring	1400	58.0	73.0	10	64.0	62.0
Spring	467	58.0	73.0	9	60.1	62.0
Summer	1400	70.0	80.0	10	71.0	70.0
Summer	467	70.0	80.0	9	70.8	70.0

* Lake surface was frozen

** Dilution is the ratio of total induced flow downstream of the discharge nozzle to the discharge flow; it may be expressed in terms of the mixed effluent temperature:

$$S = \text{dilution} = \frac{T_o - T_a}{T_m - T_a}$$

in which:

T_o = temperature of effluent

T_a = ambient temperature of receiving waters

T_m = mixed effluent temperature

REFERENCES

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APPENDIX C

DESCRIPTION OF WASTES AND TREATMENT PLAN

APPENDIX C

C1 DESCRIPTION OF WASTES AND TREATMENT PLAN

Figure 1-3, the Plot Plan - Waste Collection and Treatment Facilities presents the waste treatment plan. A description of the wastes and waste system follows.

C1.1 Industrial Wastes

The Lake City Plant will be a proposed combined cycle generating station consisting of two fuel oil burning combusion turbines and one steam turbine. The generating capacity of the station will be 250 megawatts.

Operation of the generating station will create the following wastes:

a. Water treatment sludge

b. Water demineralizer regenerant waste

c. Plant floor drains

d. Gas turbine oil drainage

e. Turbine washdown waste

f. Boiler blowdown

g. Boiler cleaning waste

h. Condenser cooling tower blowdown

C1.1.1 Water Treatment Sludge

Water treatment for various plant uses will be designed to supply 550 gpm. Treatment of this water as a first step will include coagulation-clarification-filtration for removal of suspended solids and color from the raw water. The coagulation-clarification phase of the water treatment will result in about 450 pounds per day (dry weight) solids occurring as a 1 percent sludge concentration. This equates to 5500 gallons per day of sludge which will discharge to one of two gravity sludge drying beds for dewatering. The

dewatered sludge will approximate 15 percent solids which at a density of 75 lbs/cubic foot will result in 1.5 cubic y ards to be disposed of in a state approved landfill. The 5200 gallons of filtrate will have the same chemical characteristics as the treated plant water and will combine with the other plant wastes for discharge to Lake Erie.

The gravity sludge drying beds will be constructed in concrete shells. Each bed will provide 2400 square feet of filter area and will have a 2 month service life between cleaning.

C1.1.2 Water Demineralizer Regenerant Waste

Water used for boiler feed makeup will be demineralized by a duplex set of anion-cation demineralizers. Regeneration of one anion-cation set will create:

Cation = 3170 gpm + 372 lbs H_2SO_4

Anion = 3720 gpm + 304 lbs NaOH

This will discharge into a 25,000 gallon batch operated collection tank for chemical equalization and neutralization to pH 7.0. The treated waste containing about 8640 ppm dissolved solids and 4430 ppm SO_4 will be control discharged and mixed with the other station discharges. Such control will be exercised so as to maintain the combined station effluent within acceptable limits.

C1.1.3 Plant Floor Drains

The station floor drains will combine and exit the building at one point. At this point an oil separator will be installed to provide a treatment capacity of 400 gallons per minute.

Using American Petroleum Institute parameters the unit dimensions are:

Length = 29 feet
Width = 8.5 feet
Depth = 3.5 feet (side water)

Discharge from the oil separator will combine with the other station wastes for discharge.

C1.1.4 Gas Turbine Oil Drainage

Misfiring on startup of either of the two gas turbine units could occur and result in drainage of unfired fuel oil. A

280 gallon collection tank located by each turbine will collect any fuel oil drainage. The drainage will be returned to the oil storage system.

C1.1.5 Turbine Washdown

It may be necessary to wash the turbines on a scheduled basis of one month intervals. The quantity of such washdown will be 650 gallons per turbine or 1300 gallons for the two oil fired turbines.

The washdown waste from each turbine will collect in a common sump and discharge to the boiler cleaning basin for treatment and disposal.

C1.1.6 Boiler Blowdown

The quantity of blowdown expected is as follows:

$$489{,}105 \text{ lbs/hr/boiler} \times 2 \text{ boilers} = 978{,}210 \text{ lbs/hr}$$

$$\frac{978{,}210 \text{ lbs/hr}}{(8.33 \text{ lbs/gal})\ (60 \text{ min/hr})} = 1956 \text{ gpm boiler feed water}$$

$$1956 \text{ gpm} \times .005 = 10 \text{ gpm blowdown}$$

This water will contain low dissolved solids, low suspended solids, and very little total heat quantity due to the small total volume. The discharge will be via the floor drain system.

C1.1.7 Boiler Cleaning Waste

Prior to steam boiler operation the boiler will be cleaned with alkaline-detergent - acid solutions. Each of the cleaning phases will be accompanied by a flushing operation. After the pre-startup cleaning the boilers will probably require cleaning at 5 year intervals.

The wastes produced from cleaning of a boiler will total 122,500 gallons containing phosphate, iron, and dissolved solids. The total waste will collect in a 250,000 gallon basin for batch treatment and pH neutralization.

Treatment will consist of addition of caustic (NaOH) and hydrated lime $Ca(OH)_2$ for precipitation of the phosphates and iron and neutralization of the pH. Chemical mixing in the basin will be accompanied by waste circulation through the waste discharge pump. When all dissolved phosphate and iron has been precipitated the mixing will be stopped and

quiescent settling of the precipitates will be accomplished. The clear supernatant will be control pumped from the basin. The settled precipitate will dry in the basin then removed for disposal as landfill.

C1.1.8 Condenser Cooling Tower Blowdown

A cooling tower will service the steam condenser water. The water cycle thus formed will have a system blowdown which is required to maintain the chemical characteristics of the system. The blowdown and all aforementioned wastes will combine and form one plant discharge to Lake Erie.

C1.2 Effluent Characteristics

Several preliminary conferences were held with representatives of the Pennsylvania Department of Environmental Resources and Erie County Department of Health. The following discharge characteristics were proposed and tentatively approved.

Quantity	1.75 MGD
Color	20 mg/l
pH	7.0 - 8.0
Suspended Solids	30 mg/l
Dissolved Solids	1000 mg/l
Fe - dissolved	.32 mg/l
Manganese	.44 mg/l
Dissolved oxygen saturated at ambient temperature	
Sulfate	217 mg/l

Reference to Section 3 of this report presents the expected thermal effects of the plant discharge on Lake Erie.

C1.3 Accidental Pollution Prevention Facilities

In addition to the aforementioned treatment facilties designed to collect, treat, and discharge those wastes expected from normal station operation, the following facilities have been provided to prevent accidental discharge of polluting materials.

C1.3.1 Transformer Area

A stone filled bed will surround the station transformers and oil breakers. If a rupture should occur in the transformer oil system, the escaping oil will be confined within the stone bed and subsequently removed for safe disposal.

C1.3.2 Fuel Oil Unloading and Fuel Oil Storage

As shown in Figure 1-3, all drainage from the oil unloading area will be confined and discharged into the diked area surrounding the oil storage tanks. Discharge from this diked area will be by gravity via a locked valve and under manual supervision through an oil separator. This facility will prevent stray oil as well as a large accidental discharge from this area to the Lake.

C1.3.3 Chemical Storage Tanks

All chemical storage tanks located in the station building such as sulfuric acid, sodium hydroxide, and ammonia will each be surrounded by a containment wall. The containment will have capacity to confine the contents of a full tank.

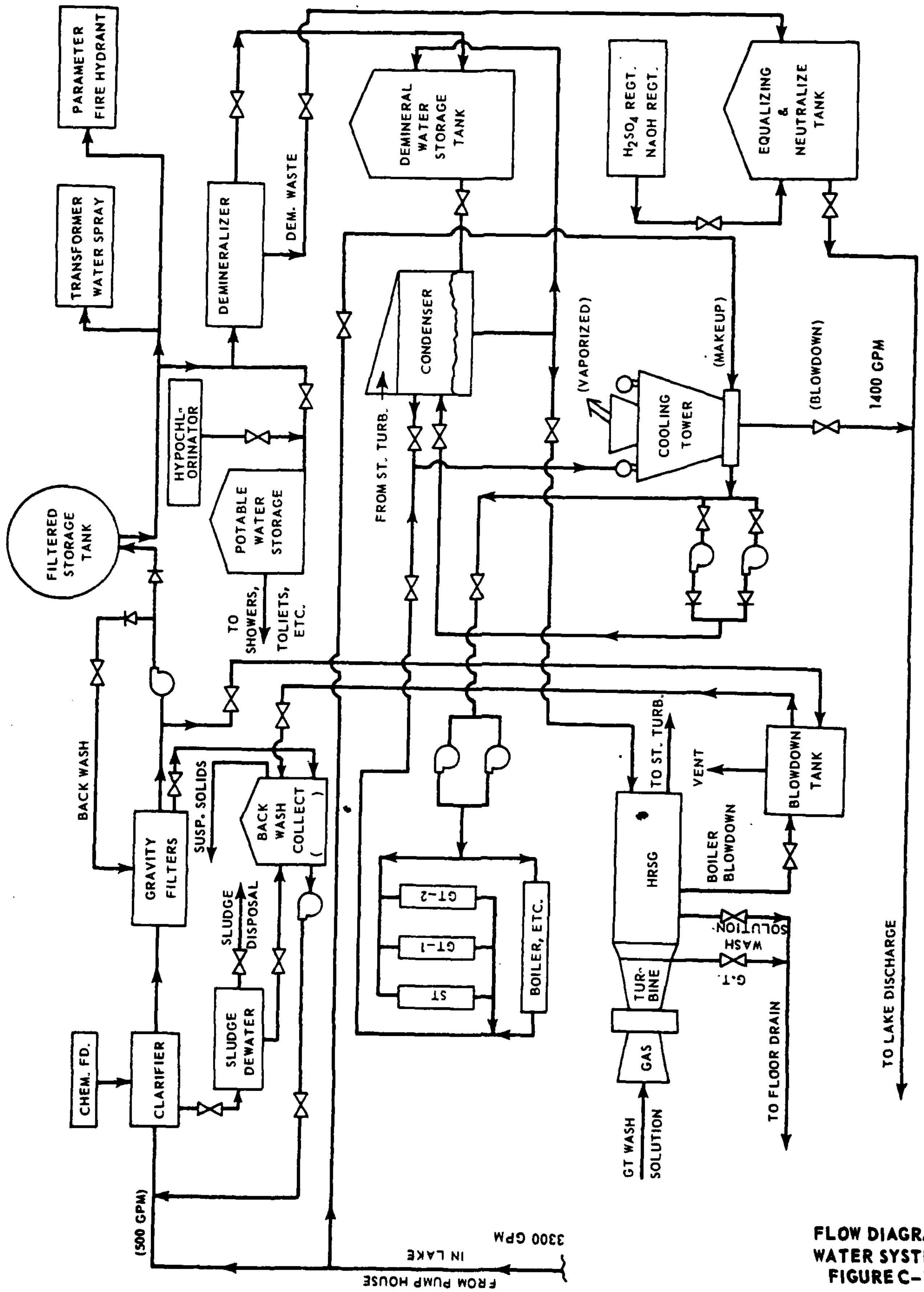
C1.4 Sanitary Wastes

An onsite sewage collection and treatment system will serve the station. The treatment system will consist of septic tanks and tile field drainage for effluent disposal.

The normal employee complement will be three to five men for each of three shifts per day with periodic maintenance force increasing the station complement to 35 people. Therefore, the sanitary system has been designed to handle 1750 gallons per day at 50 gallons per capita per day.

A permit for the facility has been recieved from the Erie County Department of Health (#163971).

PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



FLOW DIAGRAM
WATER SYSTEM
FIGURE C-1

APPENDIX D

ANALYSIS OF INFLUENCE OF BUILDING WAKE ON STACK GAS DISPERSION

FROM

LAKE CITY STATION UNIT 1
PENNSYLVANIA ELECTRIC COMPANY

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JUNE 27, 1973

APPENDIX D

D1 INTRODUCTION

Atmospheric dispersion of combustion effluents from the Lake City plant has been analyzed in Reference 1 using conventional plume rise and dispersion equations which do not consider plume behavior near the point of emission. This procedure is valid for plants having stacks that release their effluents well above the building wake.

When the stack tops are near or below the top of the wake, and wind speeds are sufficiently high to cause the lower boundary of the plume to intersect the wake, some of the effluent is dispersed downward rapidly due to the large wake turbulence, and some may enter the standing eddy, called the cavity, surrounding the building. Effluent concentrations may then be found at ground elevation at all distances from the building, at the building surfaces, and even inside the buildings if the building ventilating system has its fresh air source within the contaminated cavity.

A rule of thumb for estimating if the effluent will clear the wake, thereby permitting analysis by conventional means, is that such conditions will exist if the stack height above ground is at least 2.5 times the height of the building. For the Lake City plant, stack height is 85 ft and the height of the roof of the intake cooler house is 77 ft, yielding a ratio of 1.1.

Therefore, there is justification for the suspicion that effluent entrainment in the wake may occur.

The state of the art of analysis of effluent entrainment in building wakes is primitive. The most accurate results are obtained by wind tunnel tests using appropriate scaling parameters. Nevertheless, some estimates of plume entrapment can be made, using approximate methods based on experimental observation, insight, and application of the laws of mass conservation.

In the following sections, plume-wake interaction will be analyzed with respect to:

a. Magnitude of cavity concentrations

b. Magnitude of ground level concentrations within the wake

c. Effect of a 25 ft increase in stack height

The results of the analysis will be compared to air quality standards, and recommendations will be made regarding the need for stack extensions and for corroborative wind tunnel tests.

D2 BASIC DATA

Building and site configurations are shown on Gilbert Associates, Inc., Drawings No. C-100-502, D-089-005 and E-089-004. The orientation of the plant is such that a west wind is critical for maximum plume entrapment. The approach terrain to the west is flat and clear of trees to a distance of about 400 ft (122 m). The terrain to the east is flat and unobstructed except for two oil storage tanks, 150 ft dia. x 48 ft high, the nearest of which is 660 ft (201 m) from the building. The eastern site boundary is 2400 ft (730 m) from the building.

Figure 1 shows the building proportions. The west face is 260 ft wide (excluding small flanking structures), and 60 ft high. The roof ridge is 67 ft high. Each stack opening is rectangular, 12 ft x 6 ft-10 in., oriented with the long side in the east-west direction, and located 85 ft above ground. Effluent properties are temperature 340 F, velocity 90 ft/sec, and SO_2 release rate 291 lb/hr-stack.

D3 ANALYSIS

Conventional plume dispersion analysis assumes a uniform wind field with horizontal, parallel streamlines, into which effluent is emitted from a continuous point source. These assumptions are not valid near a building. The wind field has curved streamlines, a wake, and a cavity within the wake. The effluent is released from a finite area source with finite concentration, and forms a jet-plume which then becomes an enlarged simple plume as the jet velocities decay.

The analysis for this report will consist of separate determinations of wake properties around the building and jet-plume properties in a uniform flow, followed by a synthesis of the two phenomena and a calculation of the resulting concentration distribution.

D3.1 Wake and Cavity Properties

The wake properties assumed for this analysis are based on the material in Reference 2, which contains a summary of wake characteristics prepared by this author.

The near wake boundary shape is given by Equation 5.67 of Reference 2 as follows:

$$\frac{r_W}{L} = \left(\frac{x}{L}\right)^{1/2} \qquad (1)$$

where:

r_w = radial distance from the longitudinal axis

x = distance along the longitudinal axis from the upwind building face.

L = width of upwind face.

For this application, L = 260 ft for the lateral wake boundary at the ground, and L = 2 x 60 = 120 ft for the vertical wake boundary at the building centerline. The contours given by Equation 1 are smoothed to meet the edges of the upwind building faces, as shown in Figure 1.

The cavity boundary is proportional according to Figure 5.18 of Reference 1, with maximum height above ground equal to L = 120 ft and maximum length = 2.83L = 340 ft, with appropriate smoothing, again as shown in Figure 1.

The above proportions represent experimental data on suspended flat plates normal to the wind in low turbulence wind tunnels. Their use with buildings with a solid ground boundary in a natural wind is not entirely justifiable, but they are a reasonable approximation that represents the best available information.

The streamline pattern shown in Figure 1 was drawn by eye, using the assumption that the building disturbance decays entirely at a height of 2.5 x ridge height or about 170 ft. Note that the streamlines show the direction in which contaminants are transported, and that the cavity boundary is a streamline which separates the recirculating flow from the flow which moves downwind continuously.

D3.2 Plume Properties

The properties of real jets emitted transversely into an air stream are summarized in Reference 3. Plume rise is given by Equation (1b) of Reference 3, which reduces to the following equation when an effluent density ρ = .0497, corresponding to air at 340 F, is assumed:

$$\frac{z}{R_o} = 1.30\left(\frac{x}{R_o}\right)^{.392}\left(\frac{V_o}{\bar{u}}\right)^{.785} \qquad (2)$$

where:

z = vertical coordinate of centerline, measured from center of emission opening.

x = longitudinal (downwind) distance from center of emission opening

$\bar{u}$ = wind speed

V_o = emission velocity = 90 ft/sec

R_o = stack radius = 5.11 ft

The stack radius R_o is assumed equal to the radius of a round stack that has the same area as the rectangular stack, or $\sqrt{12 \times 6.83/\pi}$.

Figure 2 shows the plume centerlines for various wind speeds according to Equation (2). These centerlines differ by small amounts from the Briggs centerlines, but are considered to be more accurate in this region since they follow experimental data for this region only.

The real plume is assumed to disperse around the centerline in accordance with the plume boundary properties given in Figure 10 of Reference 3.

The plume centerlines, and plume, wake, and cavity boundaries are shown in Figures 3 thru 7 for wind speeds ranging from 5 to 60 mph. In drawing these figures, the effect of streamline curvature, as shown in Figure 1, was added to the plume centerlines of Figure 2. Also shown in Figures 3 thru 7 are the locations of the lower plume boundary for a stack which has been extended 25 ft.

For the existing stack height (85 ft) the lower plume boundary lies above the cavity boundary for wind speeds up to about 20 mph, but intersects the cavity boundary at higher speeds. Therefore, the cavity will not be contaminated by stack effluents for wind speeds lower than 20 mph. A 25 ft stack extension carries the plume above the cavity for wind speeds as high as 60 mph; therefore, the cavity will be protected at all normally expected wind speeds, with a 25 ft stack extension.

For distances beyond the end of the cavity (300 ft or 92 m), the lower plume boundary descends to the top of the wake boundary when the wind speed reaches about 10 mph. At higher speeds, effluent material in the lower part of the plume is diffused downward rapidly due to the strong wake turbulence. Since wake turbulence decays with distance downwind, this enhanced diffusion diminishes with distance downwind; but the effluent material, which has been brought to the vicinity of the ground in and near the end of the cavity, tends to remain at low elevations as it moves downwind. This has the effect of lowering the elevation at which the maximum plume concentration occurs at any given station, or effectively decreasing the plume centerline height.

In the following sections, cavity concentrations will be calculated first, followed by the calculation of plume concentrations in the wake downwind of the cavity.

D3.3 Cavity Concentrations

Reference 4 presents a method for calculating the fraction of plume material which enters the cavity surrounding a building. The basic formula for concentrations in the cavity is:

$$X\ (x,y,z) = \frac{FQ}{A\bar{u}}\ K\ (x,y,z) \qquad (3)$$

where:

$X\ (x,y,z)$ = effluent concentration at location x, y, z

Q = effluent emission rate

A = area of building normal to the wind

$\bar{u}$ = wind speed

$K\ (x,y,z)$ = non-dimensional concentration coefficient at location x, y, z

F = fraction of Q which enters the cavity

The effluent emission rate Q is 4 times the rate per stack or $4 \times 291 = 1164$ lb/hr $= 147 \times 10^6$ μg/sec. Each stack is assumed to behave identically with respect to penetration of the wake and cavity. Therefore, only one computation for the total effluent is required.

Building area $A = 60 \times 260 = 15{,}600\ ft^2 = 1440\ m^2$.

Concentration coefficient K is assumed as 2.4 for the region along the ground downwind of the building within the cavity (see Reference 2).

The factor F is given in Reference 4 as:

$$F = (1 - H/x \tan \beta) \qquad (4)$$

where H, x and β are defined in Figure 8. The values of F for wind speeds of 20, 40, and 60 mph were found to be 0, 0.11, and 0.17, respectively.

Introducing the above quantities into Equation 3 results in cavity concentrations of 0, 1510, and 1540 $\mu g/m^3$ for wind speeds of 20, 40, and 60 mph respectively.

D3.4 Wake Concentrations

Beyond the cavity, the turbulence field is spatially variable and no exact analysis is possible. I have assumed that the concentration distribution in the vertical at Station 4 in Figure 8 is gaussian with

a value of zero at the top boundary of the plume and a value equal to the cavity concentration at the ground. The additional requirement that the vertical integration of concentration over the total height of the plume must yield the same value as the integral over the undisturbed plume provides the remaining condition that enables one to locate the elevation of the maximum concentration, designated Ha in Figure 8. Values of Ha were found to be 158 ft, 80 ft, and 64 ft for wind speeds of 20, 40, and 60 mph, respectively.

Ha may be considered to be the elevation of the centerline of a plume from a fictitious vertical point source located upwind of the building. The plume properties at Station 4 are determined by the effective values of σ_y and σ_z at that station. The value of σ_{y4} may be approximated as one-fifth of the wake width at Station 4, from Figure 1. The value of σ_{z4} is obtained automatically in the calculation of Ha.

Downwind of Station 4, the plume is assumed to develop in a conventional manner, with the maximum ground level concentration given by:

$$Xg_{max} = \frac{Q}{\Pi\sigma_y \sigma_z \overline{u}} \left[\exp \left(- \frac{Ha^2}{2\sigma_z^2} \right) \right] \qquad (5)$$

where:

$$\sigma_z = \sigma_{z4} + \Delta\sigma_z$$

$$\sigma_y = \sigma_{y4} + \Delta\sigma_y, \text{ and}$$

$\Delta\sigma_z$ and $\Delta\sigma_y$ are the plume standard deviations as given in Reference 5, Figures 3-2 and 3-3 for distances measured from Station 4. Only neutral stability (D) is applicable because of the high wind speeds.

Graphs of Xg_{max} for wind speeds of 20, 40, and 60 mph are presented in Figure 9. The solid lines represent the existing 85 ft stack. The dashed lines represent an 85 + 25 = 110 ft stack. The double dot-dash curves are replots of Exhibit A-3 of Reference 1, and represent the 85 ft stack plume with no wake effect. In transferring the data points from Exhibit A-3 to Figure 9, the concentrations were divided by 0.56 to represent calculations according to the Turner Workbook values of σ_y and σ_z without the fifth-power variation with sampling time.

The averaging time for Figure 9 is stated to be 1 hr although the calculations used the Turner values of σ_y and σ_z directly. The power law variation represents an effect of wind meander which is important for single point source but is not important for wakes. Therefore, Figure 9 is believed to be valid for all averaging periods from 10 minutes to several hours.

Figure 10 is a cross-plot of the data in Figure 9 at the site boundary using the few available data points; curves of the variation of concentration with wind speed were roughed in. These curves show the familiar pattern of an increase of concentration with wind speed to a maximum, followed by a slower decrease at higher speeds.

D4 DISCUSSION

The curves shown in Figure 9 appear to be qualitatively reasonable in several respects:

a. At large distances, the curves developed through the present analysis approach the curves developed in Reference 1. This is more evident at the higher wind speeds because the difference between the Briggs plume height and the value of Ha derived in Section 3.4 is less at the higher speeds.

b. In the cavity, concentrations are higher at high wind speeds and effectively zero at low wind speeds. This occurs because the plume rides higher over the cavity at low wind speeds. At the high wind speeds, cavity concentrations are about the same for 40 and 60 mph, despite the 50 percent greater dilution at 60 mph. This occurs because more of the plume is captured in the cavity at 60 mph, thereby offsetting the increased dilution.

c. The variation of concentration with distance downwind follows the classic elevated plume pattern of increase to a maximum and subsequent decrease. This maximum is clearly evident where the cavity concentration is zero, and is just perceptible near the end of the cavity at a wind speed of 40 mph. No peak occurs at 60 mph.

Quantitatively, the cavity concentrations are sensitive to the magnitudes of F and K in Equation 3. More accurate results than those presented herein can be obtained only through wind tunnel tests. The rate of decrease of concentration with distance is dependent upon the assumed vertical and transverse concentration distribution. Again, no better information is available. The concentrations at large distances are not relevant to the present discussion.

Wake and cavity concentrations are of particular interest at two distances: within the cavity and beyond the site boundary.

Within the cavity, employees will be subject to concentrations of about double the SO_2 odor threshold (0.3 ppm) at wind speeds in the neighborhood of 40 mph and above. This is not considered a health hazard for industrial employees since the allowable concentration for prolonged industrial exposure, according to the American Conference of Government Industrial Hygienists is 5 ppm.

In the region beyond the site boundary, where ambient air quality standards apply, the concentration decreases from a maximum at the site boundary to the values predicted in Reference 1 at much larger distances. The site boundary concentration varies with wind speed, being zero at low speeds, reaching a maximum at some intermediate speed, and then decreasing with higher speeds (see Figure 10). The following table summarizes the concentration variation at the site boundary for two stack heights.

Stack height (ft)	85	110
Maximum speed for zero concentration (mph)	10	20
Maximum concentration:		
Magnitude ($\mu g/m^3$)	860	480
Speed (mph)	25	32
Concentration at 50 mph ($\mu g/m^3$)	620	400

To place these concentration values in context, note that the Federal secondary standard for a 3 hr averaging period is 1300 $\mu g/m^3$. Thus, the safety factor for maximum concentrations is 1300/860 = 1.5 for the 85 ft stack and 1300/480 = 2.7 for the 110 ft stack.

It is believed that a factor of 1.5 is inadequate to provide a reserve against the uncertainties of the analysis, whereas the factor of 2.7 is probably adequate.

The use of the taller stack is preferable also because concentrations do not begin to appear at the ground until the wind speed increases to 20 mph, whereas the shorter stack initiates concentrations at 10 mph. Thus the higher concentrations will be more frequent with the lower stack.

D5 CONCLUSIONS

An analysis of building wake interference with plumes from the Lake City power plant stacks indicates that significantly high concentrations, attributable to wake interference, will occur at ground level near the plant, where no concentrations were predicted in Reference 1.

The highest predicted concentration at or beyond the site boundary, with the 85 ft stack, is 860 $\mu g/m^3$. The corresponding concentration with the 110 ft stack is 480 $\mu g/m^3$. The Federal secondary 3 hr standard is 1300 $\mu g/m^3$. The safety factor of 1.5 for the 85 ft stack seems to be an inadequate reserve against uncertainties in the analysis, but the safety factor of 2.7 for the 110 ft stack appears adequate.

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The frequency of occurrence of high concentrations at the site boundary will be much less with the 110 ft stack because such concentrations begin to appear at wind speeds of 20 mph, compared to 10 mph for the 85 ft stack.

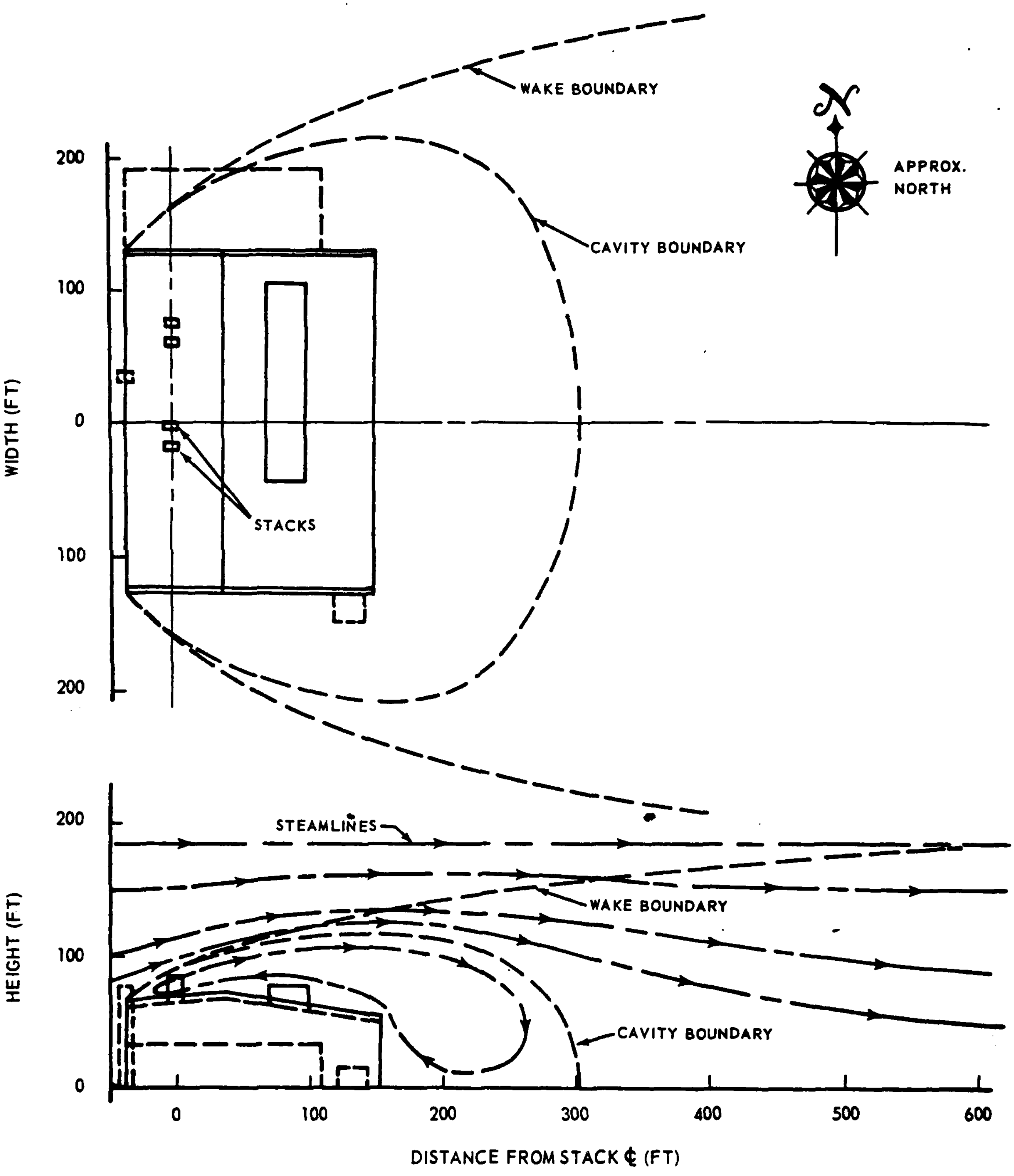
The 85 ft stack will produce cavity concentrations which are twice as high as the SO_2 odor threshold at wind speeds of 40 mph and above. The 110 ft stack will eliminate all cavity concentrations up to wind speeds of 60 mph.

D6 RECOMMENDATIONS

It is recommended that the stack height be increased to a minimum of 110 ft. This provides a reserve safety factor of 2.7 against the Federal 3 hr secondary ambient air quality standard.

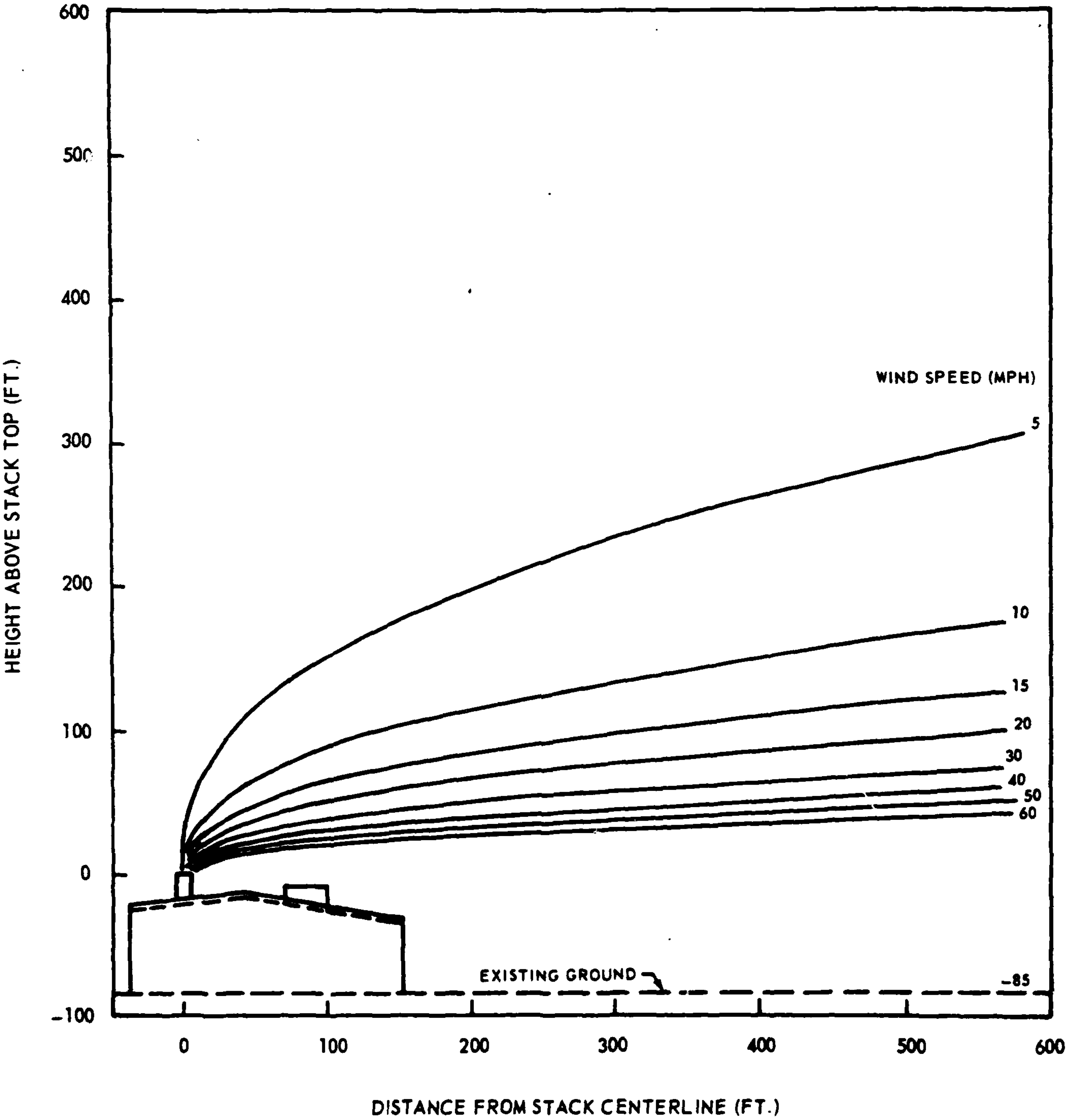
If it is not feasible to increase the stack height, a wind tunnel test is recommended to confirm the calculated reserve safety factor of 1.5 for the 85 ft stack.

PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



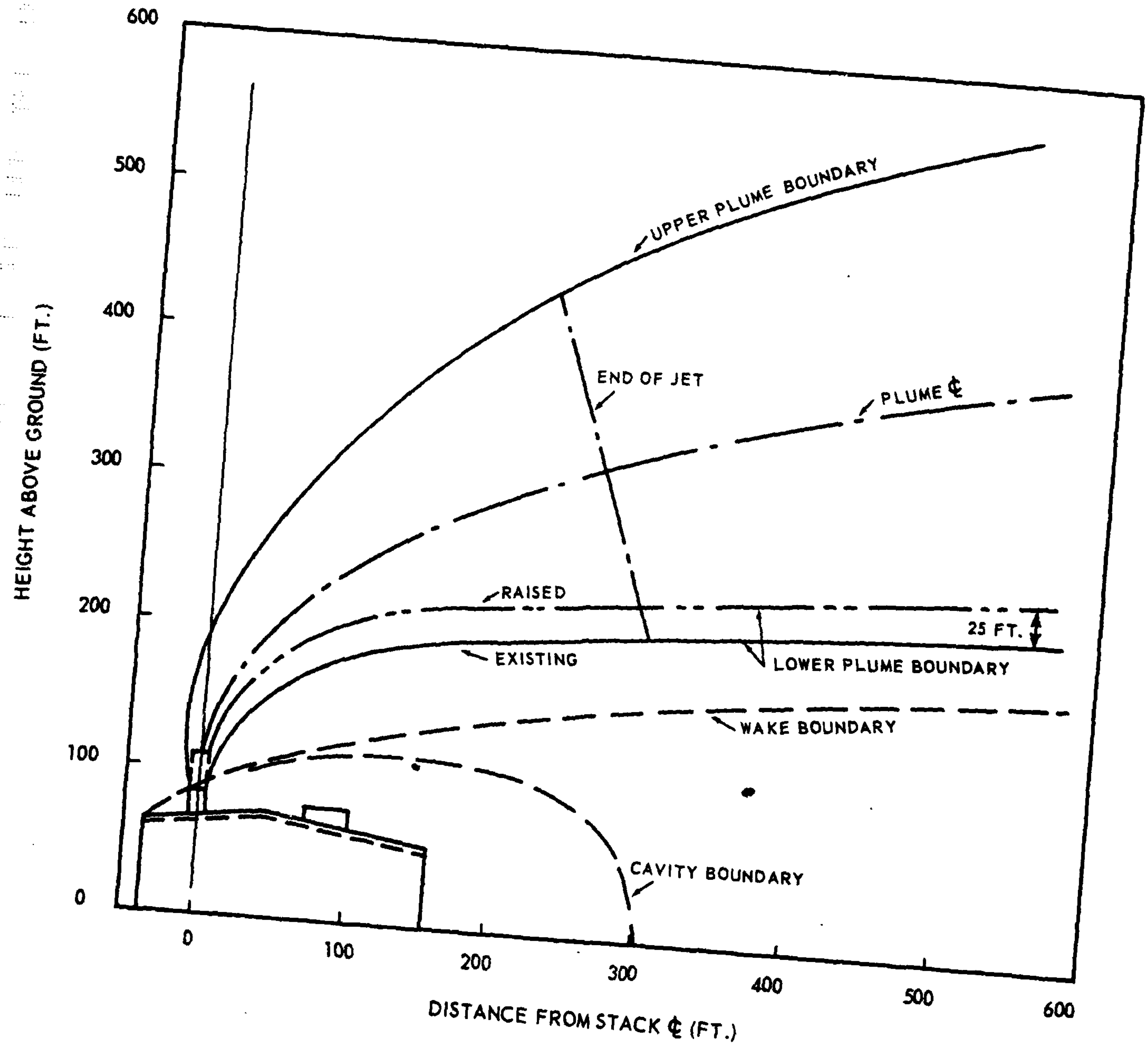
WAKE AND CAVITY DIMENSIONS IN A WEST WIND
FIGURE D-1

PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



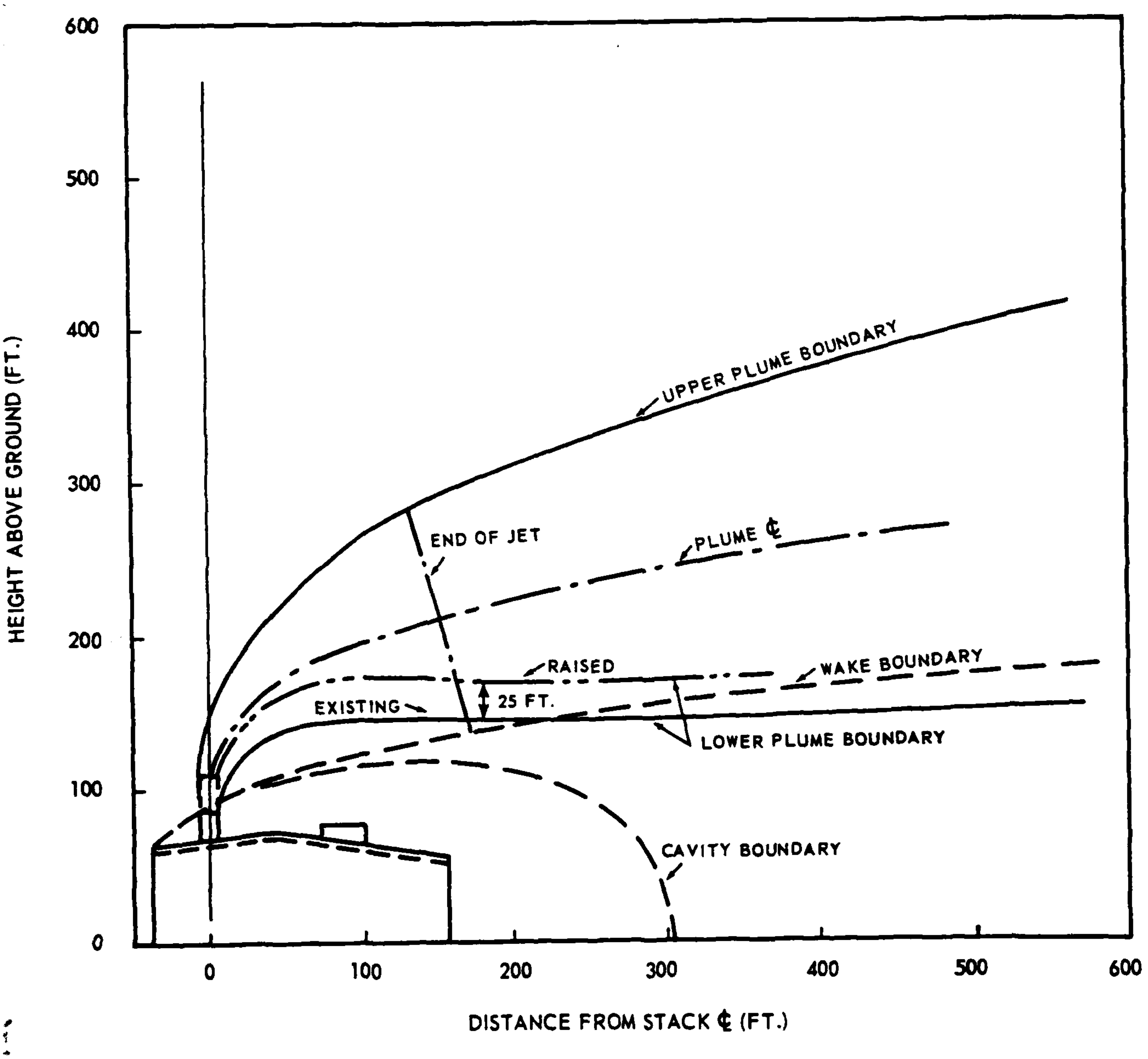
PLUME CENTER LINES
EMISSION VELOCITY = 90 FPS
EMISSION TEMPERATURE = 340F
EFFECTIVE STACK RADIUS = 5.11 FT.
FIGURE D-2

PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



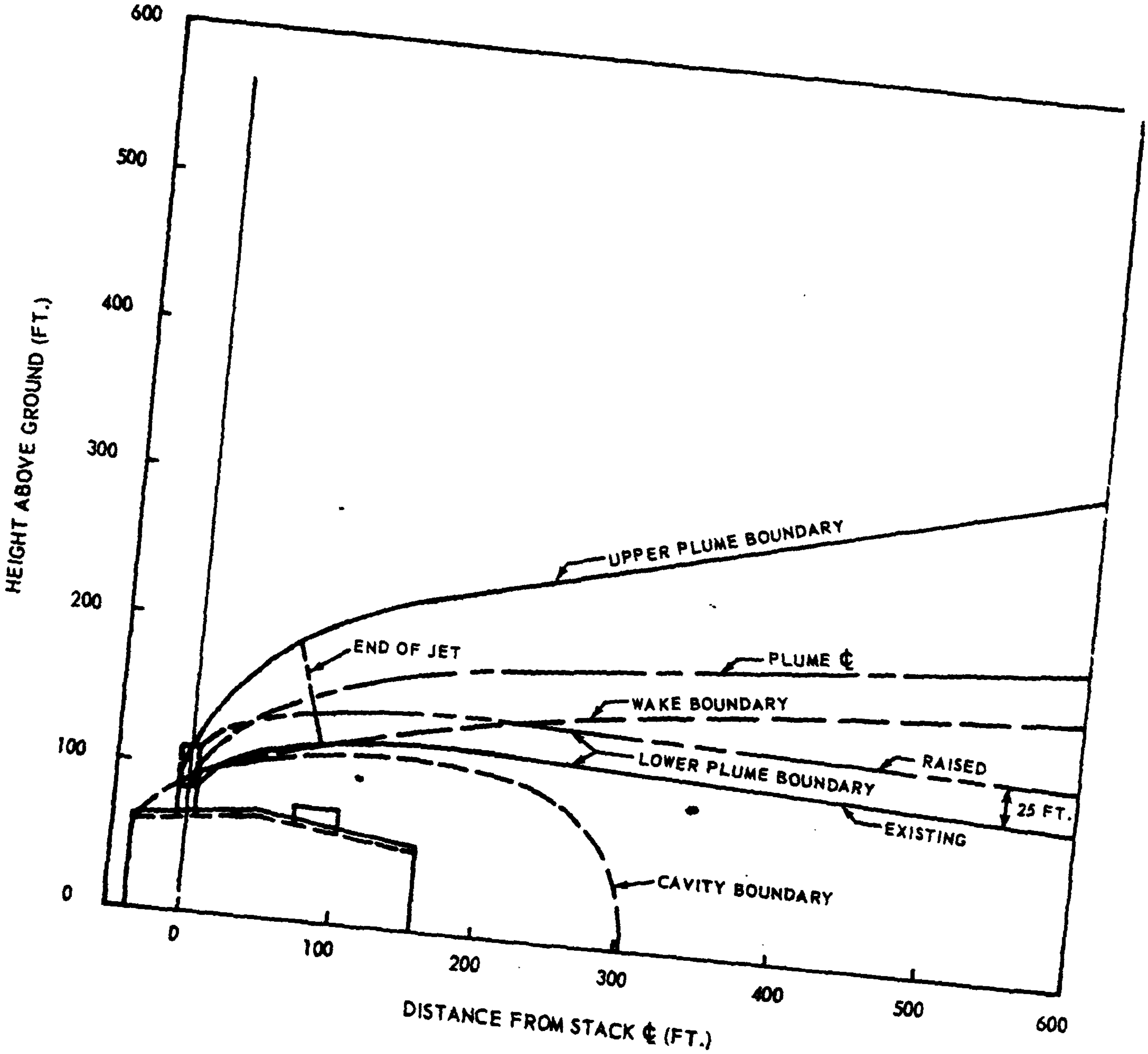
PLUME AND WAKE BOUNDARIES
WIND SPEED = 5 MPH
FIGURE D-3

PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



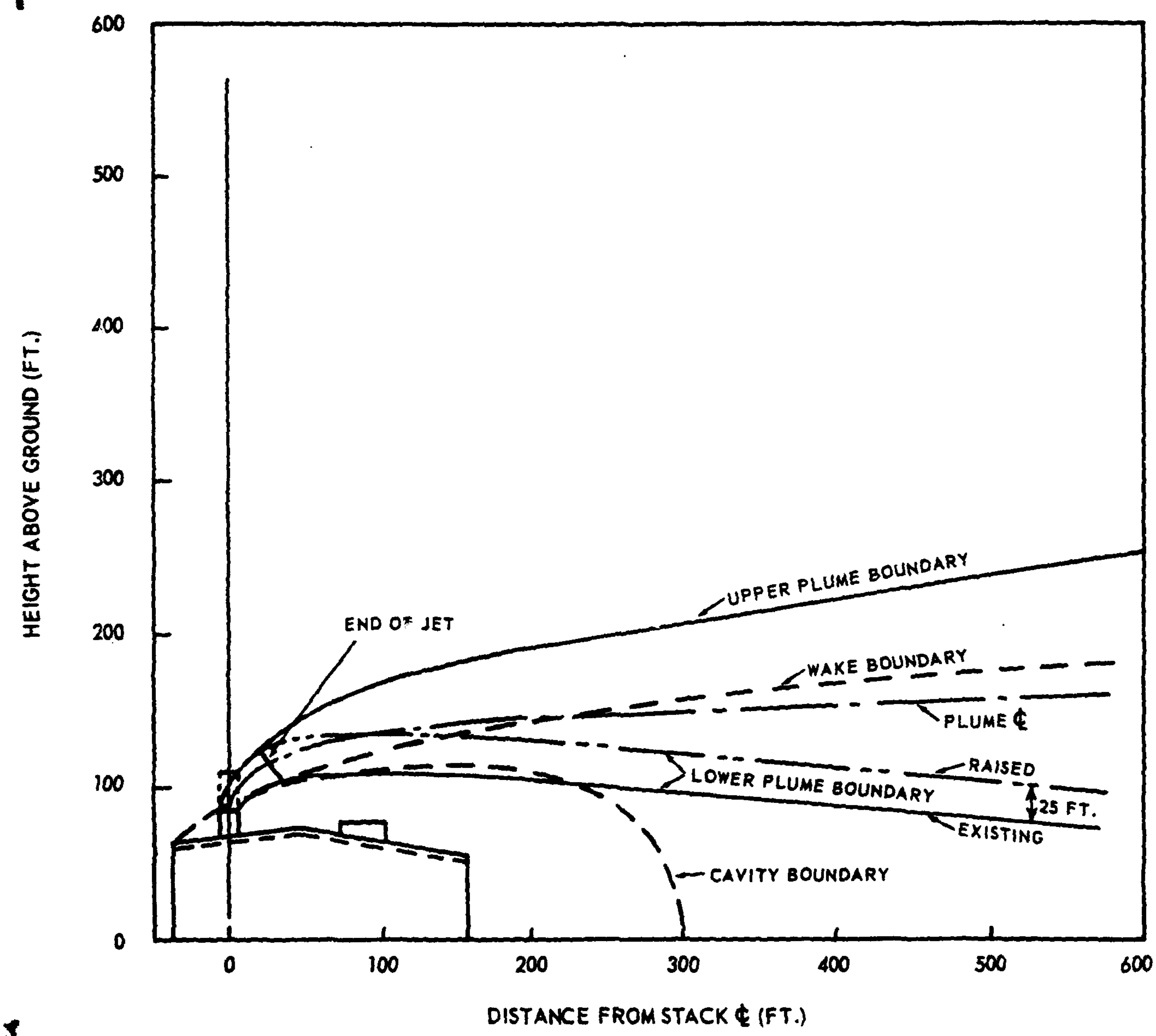
PLUME AND WAKE BOUNDARIES
WIND SPEED = 10 MPH
FIGURE D-4

PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



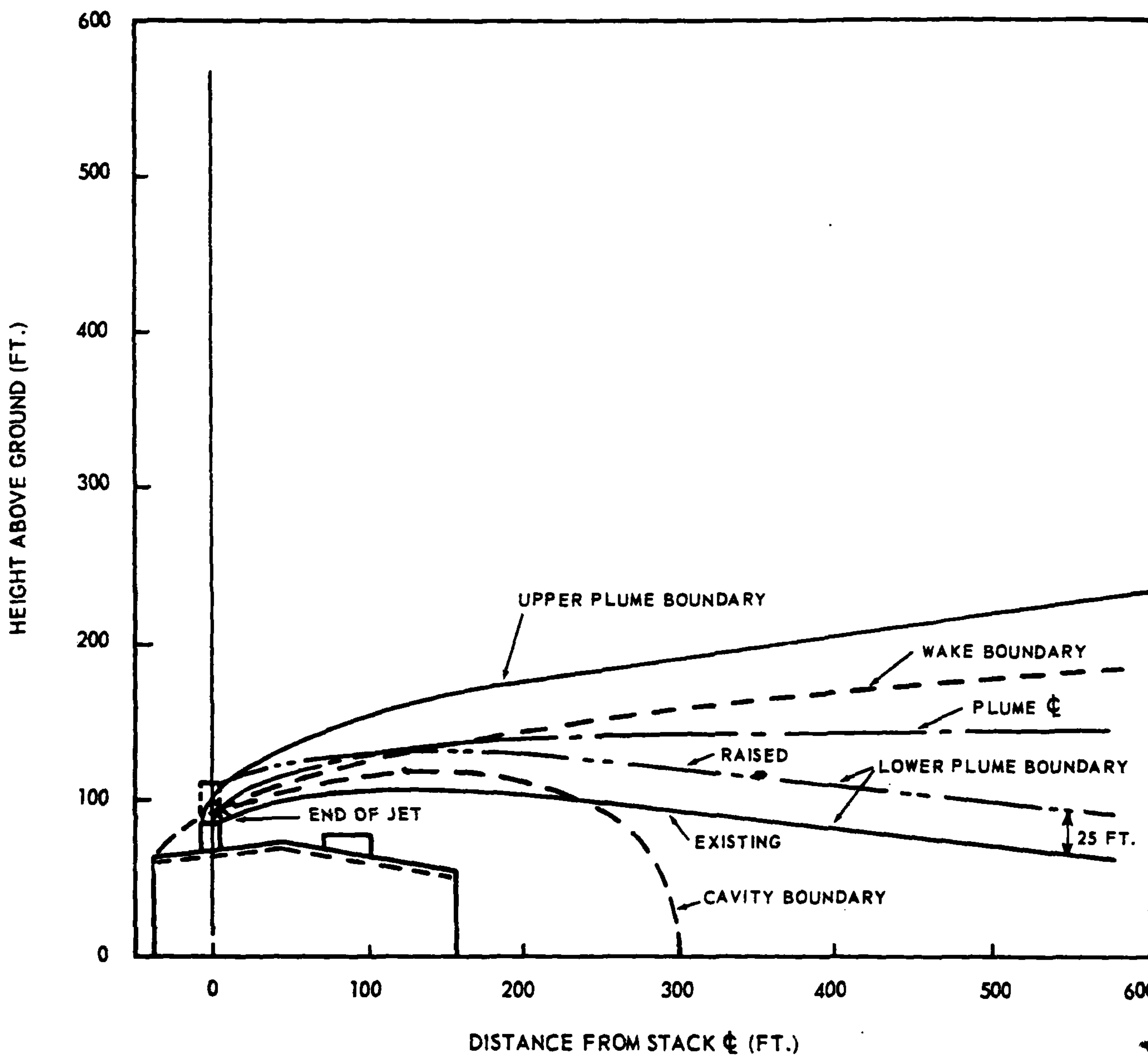
PLUME AND WAKE BOUNDARIES
WIND SPEED = 20 MPH
FIGURE D-5

PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



PLUME AND WAKE BOUNDARIES
WIND SPEED = 40 MPH
FIGURE D-6

PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



PLUME AND WAKE BOUNDARIES
WIND SPEED = 60 MPH
FIGURE D-7

PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT

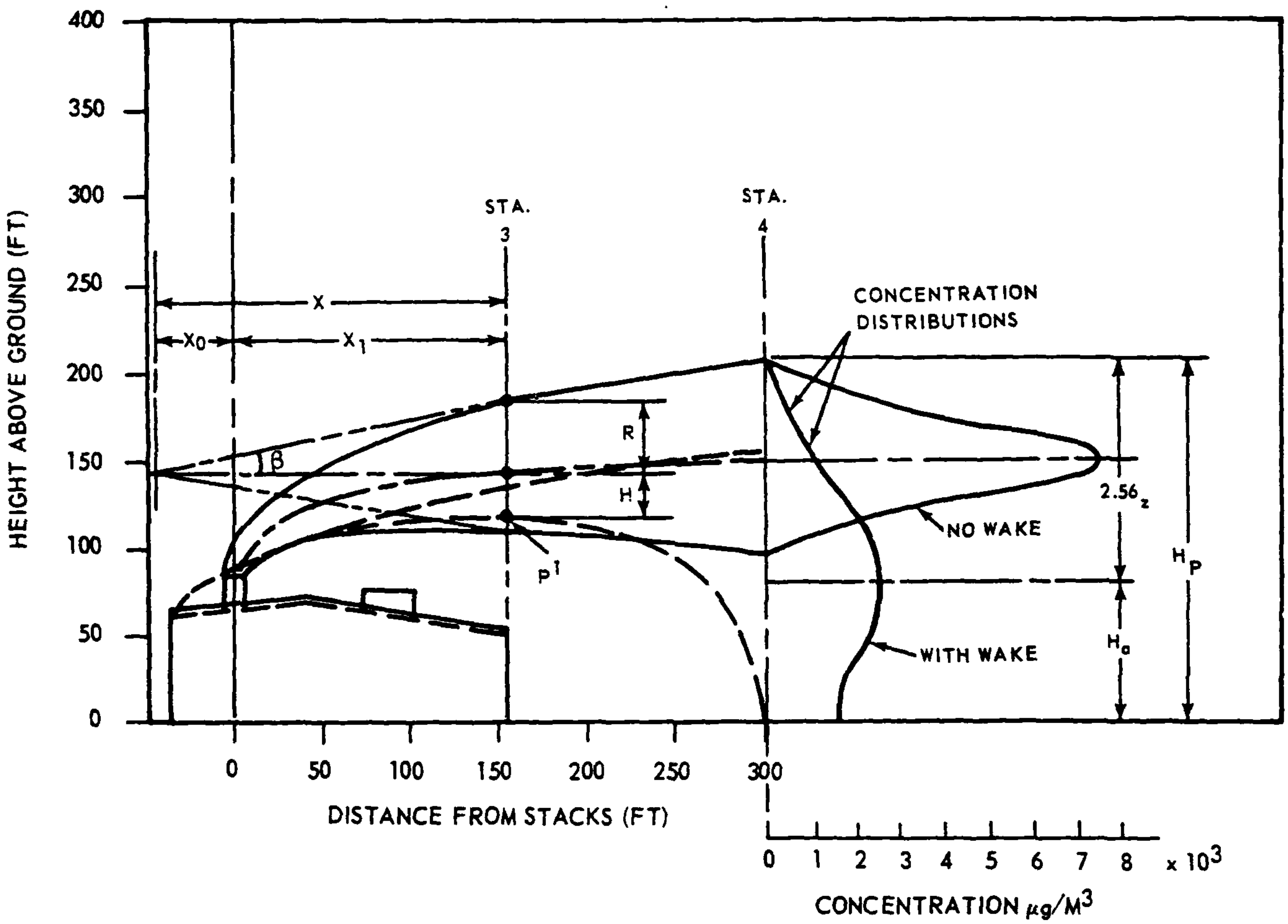
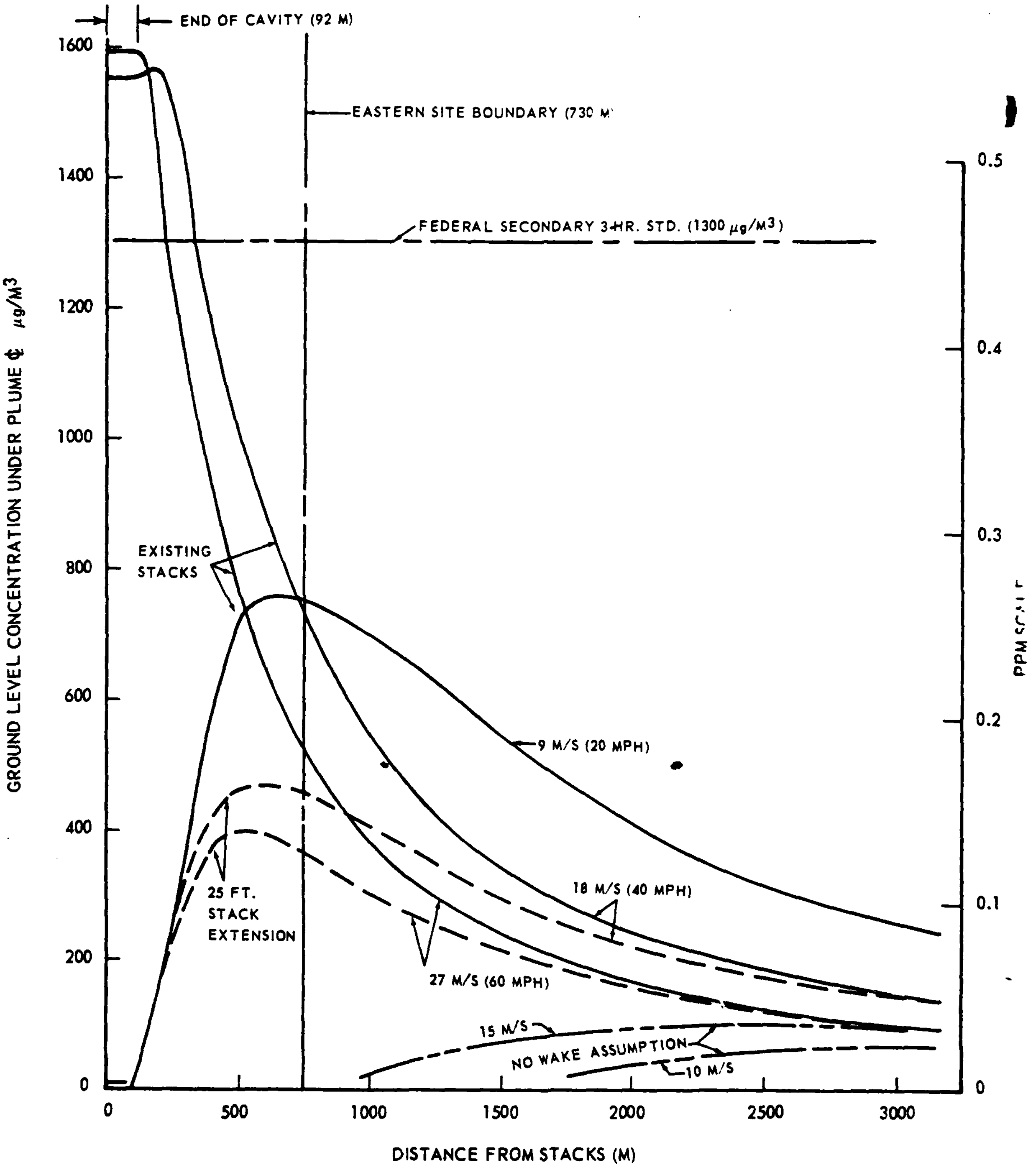


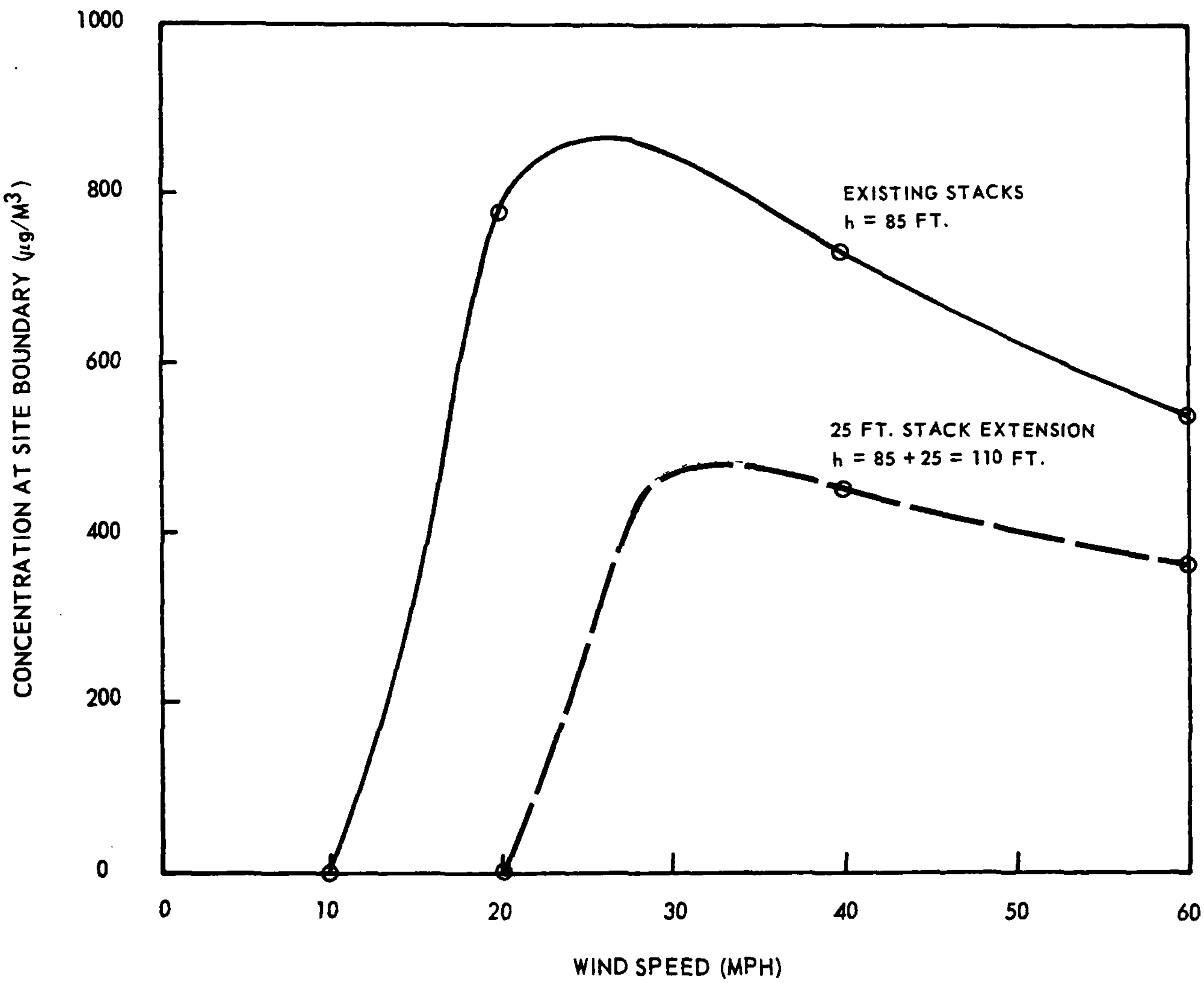
DIAGRAM FOR CAVITY AND
WAKE CONCENTRATION CALCULATIONS
WIND SPEED = 40 MPH
FIGURE D-8

PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



MAXIMUM 1-HR AVERAGE GROUND
CONCENTRATIONS IN WAKE AND CAVITY
FIGURE D-9

PENNSYLVANIA ELECTRIC COMPANY
LAKE CITY PLANT



VARIATION OF CONCENTRATION
AT SITE BOUNDARY WITH WIND SPEED
FIGURE D-10

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APPENDIX E

COOLING TOWER IMPACT AT LAKE CITY

FOR

LAKE CITY STATION UNIT 1
PENNSYLVANIA ELECTRIC COMPANY

Prepared by:

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PENNSYLVANIA STATE UNIVERSITY

MAY 28, 1973

APPENDIX E

E1 COOLING TOWER IMPACT AT LAKE CITY

E1.1 Introduction

The cooling towers at Lake City represent a very small input of heat and water vapor into the atmosphere in comparison with most modern cooling tower installations. The unit is only 100 megawatts as compared to 2000 megawatts commonly being generated on one site using evaporative cooling towers. A volume of 80,000 gallons per minute will circulate through the towers with a maximum evaporation of 1400 gallons per minute. The tower will have five cells.

Using weather data from Cleveland and Buffalo, an analysis was made of the possible impact of these cooling towers upon the environment. The potential for fog production downwind, effects upon local weather including lake storms in fall and winter, and icing in winter were investigated.

E1.2 Energy Released

For a tower of this size, effects upon weather phenomenon such as showers, thunderstorms, or lake storms are negligible. The energy release in a typical thunderstorm due to water condensation is 5×10^{11} watts. A Great Lakes snow squall releases energy from latent heat of condensation at the rate of 10^{13} watts. The Lake City Station will release less than 10^{8} watts. Thus the energy release of the cooling towers is something less than one one thousandths (10^{-3}) of that in a thunderstorm and one one hundred thousandths (10^{-5}) of that in a lake storm. The moisture flux over the lake shore during a lake storm is of the order of 5.28×10^{10} gms/sec as compared to evaporation of 85,000 gms/sec at the plant.

E1.3 Plume Rise

Induced draft cooling towers of the type being used have been known to produce fogging or icing downwind. To determine quantitatively what the magnitude of these problems might be in this case, one must calculate the effective source height of the water vapor. The towers are 60 feet above grade. The five cells of the tower are all together in one unit and will, to some extent, tend to help each other in preserving buoyancy from individual cells by preventing dry air entrainment. To be conservative, we have calculated the plume rise using a single cell. The actual plume rise will often be greater due to combining of plumes from several cells. The Briggs equations as modified by Hanna [E-1, E-2] have been used to calculate plume rise for a single cell. Table E-1 is presented as verification of the technique of computing plume rise. It can be seen that the calculations give reasonable values of height. This table is derived from data taken in 1972 at the Benning Road Station in Anacostia, Maryland, where an installation of 8 cells all larger than those proposed at Lake City were in operation. During these observations no fogging or icing occurred at the ground.

TABLE E-1

OBSERVATION OF COOLING TOWER VAPOR PLUME
PEPCO BENNING ROAD STATION - 8 CELL MECHANICAL DRAFT TOWER

CONDITIONS		2-8-72	2-9-72	2-11-72	2-15-72	2-16-72	2-17-72	2-22-72	2-23-72	2-24-72	2-27-72	3-3-72	3-16-72
		DATE OF OBSERVATION											
Dry Bulb Temp.													
Surface	F	15	22	29	35	38	29	40	23	35	24	45	41
Cloud Top	F	4.8	9.8	24.1	47.8	35.1	29.5	37.9	20.8	34.3	24.6	40.6	38.1
Temp. Lapse Rate, F/ 1000 ft		-0.16	-5.85	-4.30	12.9	-5.94	0.75	-3.88	-2.53	-1.02	0.91	-6.51	-4.89
Relative Humidity													
Surface	%	82.6	76.0	50.3	78.6	55.7	61.7	51.2	87.0	95.0	82.0	53.0	85.0
Cloud Top	%	65.3	60.0	53.6	40.3	44.6	61.1	51.8	88.4	79.4	82.3	51.5	81.2
Average	%	74.0	68.0	52.0	39.5	50.2	61.4	51.5	87.7	87.2	82.2	52.3	83.1
Wind Speed													
Surface	mph	6.9	4.6	2.2	6.7	6.9	5.8	9.0	6.9	2.2	9.0	8.5	6.9
Cloud Top	mph	16.1	8.8	5.1	19.2	12.3	11.5	12.4	11.9	10.9	9.8	10.6	12.8
Average	mph	11.5	6.7	3.7	13.0	9.6	8.7	10.7	9.4	6.6	9.4	9.6	9.9
Wind Direction	deg.	330	91	0	190	250	200	290	170	200	200	330	130
Angle Between Tower Long Axis and Wind Direction	deg.	60	0	90	80	20	70	20	80	70	70	60	40
Initial Vapor Temp.	F	91.0	84.0	92.1	93.5	90.5	92.5	87.5	87.0	93.0	92.5	93.5	81.0
Max. Visible Plume Height	m	633	659	371	173	326	225	189	289	232	225	230	205
Predicted Plume Height	m	323	462	882*	103	267	365	172	326	194	240	238	256
Max. Plume Length	m	869	1000	706	532	433	653	565	938	604	680	709	1000

* Strong elevated inversion

Table E-2 gives plume height values for the cells at Lake City for two stable cases and for three wind speeds. For unstable conditions plume rise will be much greater.

TABLE E-2

COMPUTED PLUME RISE FOR LAKE CITY COOLING TOWERS
Using Briggs-Hanna Equation (Meters)
Stable Cases

Wind/Lapse Rate	Isothermal	+2 F/1000 ft
calm	367	273
1 m/sec	224	178
3 m/sec	156	123

From Tables E-1 and E-2 it is clear that the plume always will go 100 meters or more in height and under most potential fogging conditions much higher. Fog is only likely from the towers with light winds and stable air. At these times, as is seen in Table E-2, the plume rise is several hundred meters. With strong winds, the dispersion is so rapid that downwind concentrations quickly diminish to negligible values. When natural fog is present, the lack of dry air entrainment permits latent heat release to increase buoyancy and the plume will rise more rapidly than indicated in Table E-2 and will not increase fog density at the ground.

From Hilsmeier and Gifford's (E-3) tables we would expect the $\bar{X}\bar{U}/Q$ values for a 100 meter release height to range between 10^{-5} and 10^{-6} at a distance of 200 meters and then only in unstable cases. In these unstable cases, the wind will be moderate and the effective source height will be more like 500 meters due to the plume rise under unstable conditions. The actual ground concentration will be much less than these $\bar{X}\bar{U}/Q$ values will indicate. But even assuming a 100 meter release, this results in very low water vapor concentrations downwind. The evaporation rate from all five cells is a maximum of 85,000 grams of water per second. With a 5 meter per second wind (average for unstable conditions), this means that at 200 meters downwind, the concentration of water vapor from the tower under unstable conditions will be between .17 and .017 grams per cubic meter. When the air is unstable, the surface humidities will result in saturation deficits of several grams or more per cubic meter and the consequence of the tower will be to raise the relative humidity, by at most, a few percent 200 meters downwind.

Under stable conditions, when winds are light and humidity at the surface is high, $\bar{X}\bar{U}/Q$ values at distances between the towers and 2000 meters will be less than 10^{-7}. At one meter per second wind speed, this gives concentrations of water vapor downwind of .0085 grams per cubic meter against a natural background of a minimum of 5 grams in winter and up to 25 grams in summer.

E1.4 Fogging and Icing

To assess the meaning of this in terms of frequency of a plume persisting downwind or reaching the ground to form fog, one can tabulate the frequency with which the atmosphere is in the range of wind speed, stability, and saturation deficit when a problem might exist. From data taken at Buffalo, New York, which is judged to be representative of wind and humidity conditions at Lake City, one obtains the number of hours when the saturation deficit (saturation minus actual water content) is within certain limits.

Table E-3 includes the average number of hours over a 10-year period, by months, when the saturation deficit was between .5 and .1 grams per cubic meter. It is seen that even if we assume the worst diffusion condition at 200 meters downwind as indicated above which would give (.17 grams per cubic meter) we have only 7.1 hours per year of plume beyond 600 feet. Under stable conditions, the plume would on the average, never reach 200 meters downwind. Only under an occasional extreme condition with very high humidity, very stable air, and low winds would the plume extend beyond 200 meters and then at elevations of more than 200 meters above the ground.

Since the plume will be elevated, icing downwind is not a problem except in the first 200 feet from the towers. In moderate winds the plume may be sucked down into the wake cavity behind the tower and temporarily reach the ground before again ascending due to its buoyancy. Also, within two hundred feet, the few large drift drops which escape the drift eliminators will fall to the ground and under below freezing conditions will freeze on striking structures or the ground. This icing will not extend to the plant boundaries and will be light due to the small amount of drift.

E1.5 Summary

In summary, the evaporative cooling towers at Lake City will have no detectable impact beyond the plant boundary either in producing fog, ice, or in affecting rain or snowfall. Observable effects will all be within 200 meters of the towers and confined to occasional fogging and a small amount of icing in winter.

TABLE E-3

TEN-YEAR AVERAGE NUMBER OF HOURS OF SATURATION DEFICIT
BELOW ONE-HALF GRAM, BY MONTHS

Buffalo, N. Y. 0-4 mph

Sat. deficit grams	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
.5	31.7	25.5	24.1	20.2	14.6	4.9	0.0	3.9	13.0	40.4	23.6	24.0
.4	25.6	22.8	20.4	9.1	3.7	0.0	0.0	0.0	2.4	18.1	16.1	19.0
.3	14.7	10.3	10.8	1.3	0.0	0.0	0.0	0.0	0.0	0.5	3.3	7.4
.2	3.6	3.5	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
.1	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
% of Total	10	10	9	11	14	15	14	21	16	18	12	9

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